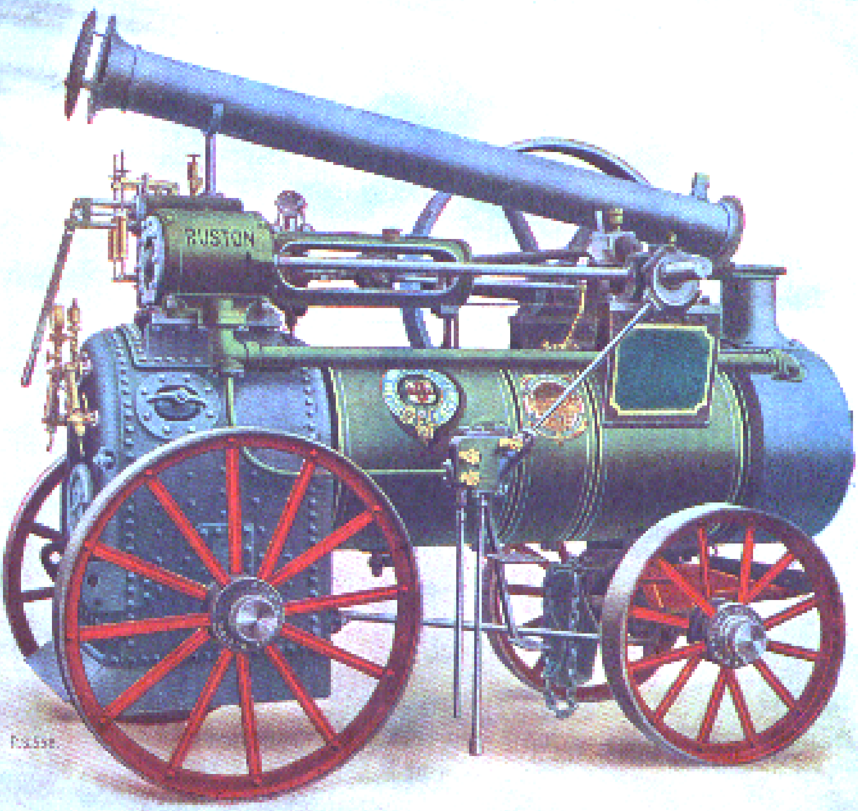
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

About this Issue

● CHRISTMAS IS close upon us once more, and this issue of THE MODEL ENGINEER is offered as a special seasonal number appropriate to the occasion. Readers will notice one or two unusual but important features; for example, there are 72 pages between the covers, but the price has not been increased. There are plenty of constructional articles, notes and diagrams to give readers at least the usual amount of reading and working matter before and during the holiday.

Old friends amongst our readers will recall that we have produced special issues from time to time in the past, usually at Christmas and at the time of the "M.E." Exhibition. It is our intention to continue this policy in the future, and even to extend it, by publishing these bumper issues at regular and, we hope, more frequent intervals.

And so, with this issue and the expression of our hopes for the future, we extend our best wishes to advertisers, contributors and readers everywhere for successful preparations for the Festive Season.

Our Cover

● THIS WEEK'S cover, as will be seen, is quite different from any previously used for THE MODEL ENGINEER, and we hope our readers will appreciate it. The portable engine is attracting a lot of notice in our pages at present. The engine depicted is a Ruston and is quite a typical example of its kind. The reproduction gives a clear idea of the colours used in painting such engines. Usually, the colours were chosen by the makers, though the customer would sometimes specify and insist on his own colour scheme.

Whatever the colours, however, the finish was always of a very high standard, especially in the older engines which were painted by men who were real masters of their craft. The same care and skill which were put into the design and construction of the engine were also put into the painting; nothing but the best would do, and the result was an engine in which anyone who and had anything to do with her, from start to finish, could well feel proud.

From One of Our Older Readers

● WE WERE much pleased and gratified to receive a letter from a reader in Devon who is now subscribing to THE MODEL ENGINEER again, after a break of many years; for he writes: " I should like to point out that, on the evidence of the style and make-up of your present MODEL ENGINEER, to which I have now found time to subscribe again after many years, both the craft and the journal have advanced enormously. I do indeed congratulate you on

the excellent standard of 'our' journal, and on the fairness of the balance achieved of contributions appealing to the various sections of our hobby."

Coming as this does from a reader who, presumably, lost touch with THE MODEL ENGINEER for some years, the comment is especially encouraging to all the "M.E." staff; we may not always be successful in striking a perfect balance in one issue, or even in two or three consecutive issues, but we do our best to see that each of the many interests of our hobby receives its due share of attention. A wall-chart in our Production Dept. contains no fewer than thirty different main headings, each a subject to be catered for by THE MODEL ENGINEER, and each capable of more or less subdivision; by this means, we are able, not only to see what subject has been neglected, but also to plan in advance to balance the contents of issues according to the material available. This chart was instituted some five years ago and soon proved to be of inestimable value.

The "M.E." Speed Boat Competition

● WE WOULD remind model power boat enthusiasts that entries for this annual competition are accepted up to December 31st of this year. In view of the great popularity of this branch of model engineering, and the activity which has taken place during the past season, we hope to receive a record number of entries. Separate classes are open to boats conforming to M.P.B.A. restrictions in "A," "B" and "C" classes, and "D" class will also be recognised if supported by the number of entries received; silver and bronze medals are awarded for the best performances in each class, both for steam and petrol driven boats, and certificates for all boats which attain specified standards of speed. Both the hull and the power plant must be the work of the competitor, though some latitude is allowed in respect of components purchased in a finished or part-finished state if full particulars are given on the entry form. In the case of runs which have been made at public regattas organised by the M.P.B.A., the evidence already available in the timekeepers' records will be accepted in respect of speed attained; in other cases, the signatures of timekeepers and witnesses must be submitted on the entry forms, which may be obtained from this office. All applications should be accompanied by a stamped addressed envelope.

Boss White

● IN A long letter dealing with matters arising out of B.C.J.'s recent article on portable engines, Mr. Andrew Todd, of Colwyn Bay, adds a paragraph referring back to the letter from Mr. E. A. Searles in the August 24th issue. Since no other reader seems to have answered Mr. Searles's question, "What is Boss White?" some comments by Mr. Todd are worth quoting; he writes:—

"Boss White is a good pipe-jointing material; I have used many hundredweights of it. There are a number of similar preparations on the home market; most of them can be bought in graphited form, and if there is a quicker way of making yourself in a mess than by using this graphited stuff, I have yet to learn it! I recently had a job assembling cast-iron tanks, all the seams of which were jointed by a graphited paste. The bolts were grummeted with this paste and hemp grummets. The tanks were about 6 ft. deep and 16 ft. square; they were dismantled at another works and re-erected on their present site. They had originally been jointed with graphited paste, and when I dismantled them the joints broke cleanly and every nut unscrewed easily from its bolt. If red lead had been used, many of the bolts would have been scrapped; so graphited material has its uses!

"My only objection to Boss White for home use is that it is sold in tins that are too big; a 1-lb. tin lasts for years, but long before it is finished the stuff has gone hard. The best material that I know for home use is artists' white lead in oil I have had a sixpenny tube of this in use for 10 years; there is still some in it and it is still soft. The amount used in building a $2\frac{1}{2}$-in. gauge locomotive is very small, and it is so easily applied from the tube direct on to thread or fitting. There is no waste, no dirty fingers; it is cheap and *always* ready for immediate use."

A New American Locomotive Track

● WE HAVE received a copy of a circular letter issued by the Golden Gate Live Steamers, Inc., of Oakland, California, U.S.A. It announces that, at the time of writing, their outside track in Redwood Regional Park, Oakland, is almost completed and will be officially opened for running at a meeting in the near future.

The track consists of a heavy trestle roadbed upon which rails have been laid in a complete loop, 1,330 ft. long and accommodating $2\frac{1}{2}$-in., $3\frac{1}{2}$-in. and $4\frac{3}{4}$-in. gauges. Water facilities are being installed, and power is being made available for electrically-driven blowers used for steam-raising. Speed boards are being placed at certain curves, the minimum of which is 30 ft. radius while the maximum is 83 ft.

Operating rules are based mainly on those laid down by the New England Live Steamers, the most important being the requirement of tests for boilers and safety-valves. Boilers will be tested hydraulically to a pressure of 50 per cent. greater than the blow-off setting of the safety-valves.

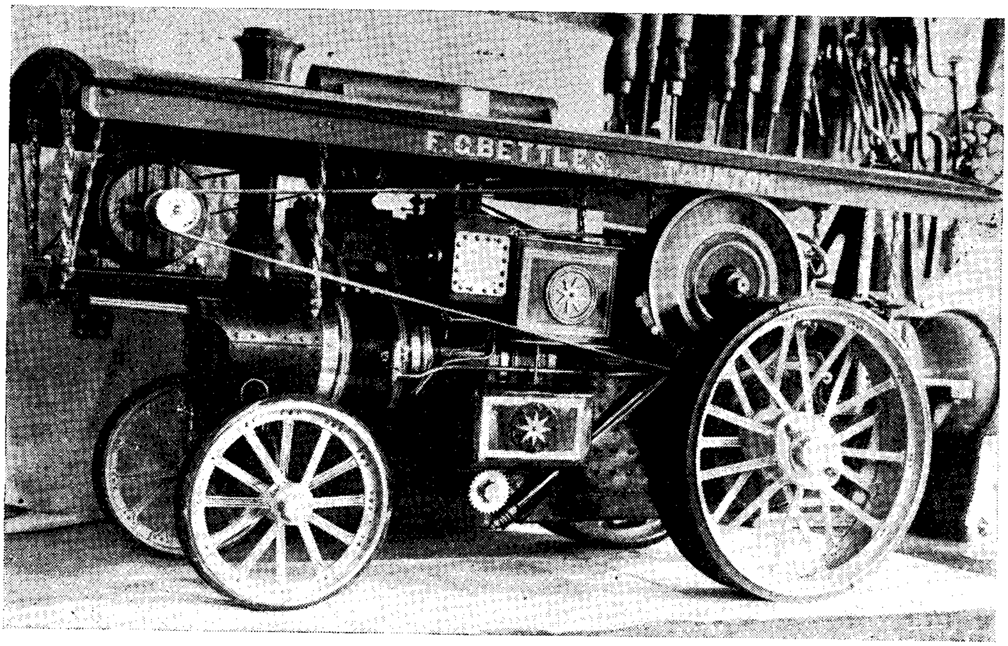
We are interested to note that the safety precautions specified are the same as those generally applying here in Britain, and we can well understand the advisability of providing speed boards; we would be interested to know what speeds they specify.

We wish the new track all possible success and many years of happy meetings. The track is governed by a board of directors consisting of: The president, V. T. Shattock, of Oakland; the secretary, H. L. Dixon, of Hayward, and a member, T. Reardon, of Oakland. If any of these gentlemen would care to send us some photographs and an account of the opening meet, we would be glad to have them and, if space permits, publish some of them; they would be interesting to compare with those of track meetings in Britain.

*A $1\frac{1}{2}$-in. Scale Showman's Engine

by F. G. Bettles

I THINK the second shaft and differential gear explain themselves, if well examined, before starting work on them. The three mains gears on this are cut from mild-steel plates $\frac{3}{8}$ in. thick which, when cleaned up, are a little over $\frac{5}{16}$ in. They are cut 24 d.p. with 120, 108, and 96 teeth. The pinions on the crankshaft are 24, 36, and 48, which, in each case, add up to 144. If 0.090 in.



Showing the near side of the engine, on the workshop bench

is added to the pitch-line diameter, thus, 120 = 5 in. + 0.090 = 5.090; outside diameter of gear blank is 5.090; and so on. It will be noticed that the low gear and intermediate gear blanks enclose the spider, and lock in the pins of the planet-wheels. They are relieved of all surplus metal to keep down the weight, and should now be press-fitted on the spider and the bolts put in.

The spider is put on a mandrel, with a lock-nut to make sure it cannot turn. The low-gear blank is now turned down to 5.090 in. and the 120 teeth cut. When all this is finished, it must be removed, leaving the intermediate or second gear blank remaining for cutting, as before. On the inside of this blank a register must be turned 4.090 in. to take the 96-tooth high gear, as this is fixed on with only a flange. In order to cut it, it must first be bored to fit the spider mandrel and then turned down to cut the teeth, relieved, as shown, and parted off. Bolt this on loosely, and test with the other two gears on the mandrel. This should be absolutely correct.

The sun wheels, or the two large bevels, are 2 in. in diameter on the pitch-line and are cut 20 d.p. The three planet-wheels are $\frac{3}{4}$ in. on P.L. and cut 15 teeth. Silver-steel pins of $\frac{3}{16}$ in. diameter are used for these pinions. The spider is machined out of the solid steel disc and no castings whatever are used.

The two pinions for the last drive are 22 teeth, 20 d.p. 1.2 in. p.l.d. and the blanks are 1.308 in. diameter. The one on the off-side (differential) is a push-fit on a spigot of the outside of the sun wheel; three 8-B.A. steel screws retain it and act as keys. The cross shaft is high-tensile steel, drilled for oil-way. Be careful to drill the communicating hole to differential gears and tap $\frac{1}{8}$ in. for clamping-screws to stop the oil, and hold the end-plates retaining the gears. All these gears must be fitted to the shaft with a good push-fit, and key-wayed so that they can be removed at any time with very little effort by a drawer. The main trunk bearing bracket, which not only carries the shaft, but also ties the horn-plates

*Continued from page 782, "M.E.," November 23, 1950.

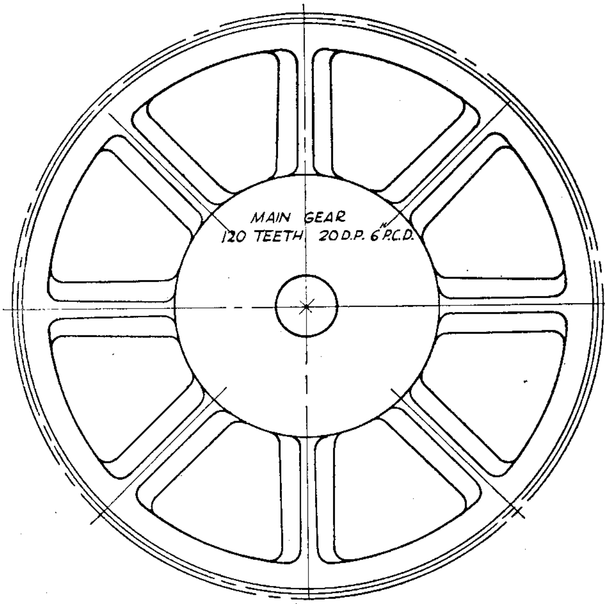
together, is put in from the offside of the engine and should be machined on the flanges so that both are against the plates so that all the strain does not come on one of them.

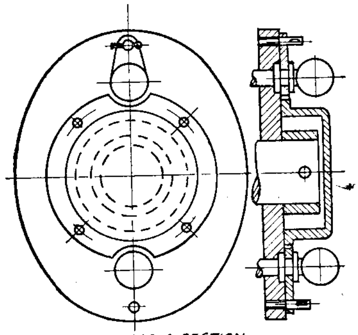
The main axle is also of high-tensile steel (old car axle shaft) and the casing is a gunmetal bush screwed with a right- and left-hand thread, so that the plate nuts can be adjusted between the horn-plates to exact pressure before securing by $\frac{1}{8}$-in. bolts and nuts.

Some people might ask why the engine was not spring-mounted. This was all completed, but discarded because, with rubber tyres, it was considered better to tie the copper horn-plates firmly together rather than to fit a doubtful spring mounting. The method used on the Burrell was not over-good, but it is rather a tricky question to discuss in an article like this.

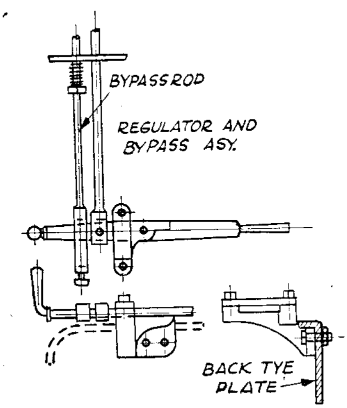
The last gears to cut are the main road drive. These are made of cast-iron, 6 in. pitch-line diameter, blanks 6.108 in. diameter, 120 teeth, 20 d.p. The spokes, eight in all, are cut from the one pattern, and are used to serve both sides. It will be seen that wire rope drum is formed as part of one of these wheels while the other is turned down, as shown.

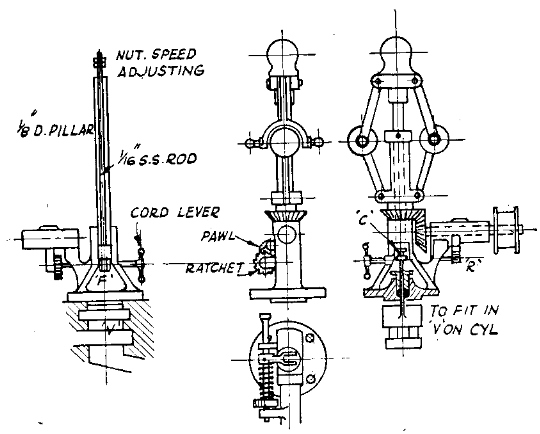
The road wheels have been described several times, and diameters, etc., are given on drawings. The rims are not made from cast-iron machined out, but are wrought iron or mild-steel. The weight of the iron to begin with is about 9½ lb. but finishes at about 2 lb. If dropped, these do no smash, however. They are 2½ in. wide and $\frac{5}{8}$ in. thick at the back, and the front wheels are

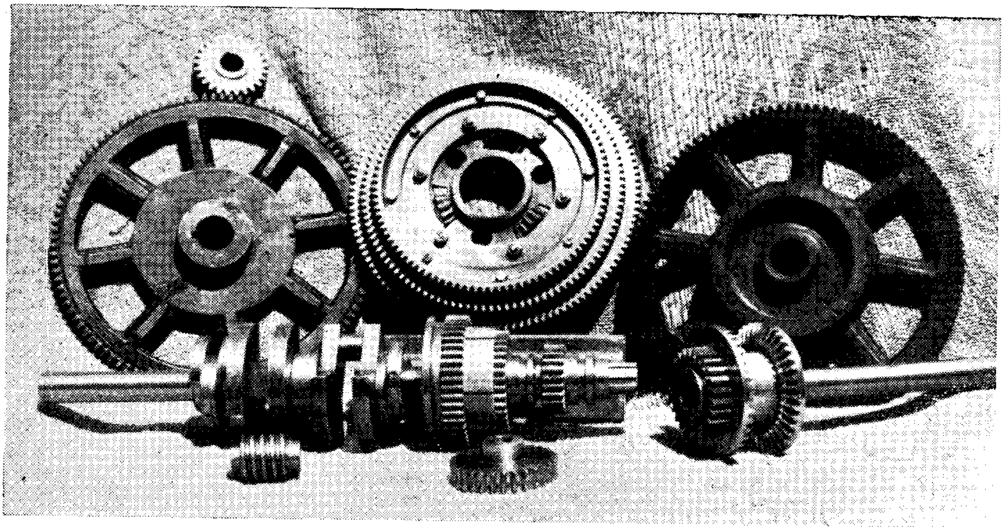




HUB FACE & SECTION
(SHOWING PINS, BRASS CAP &c.)





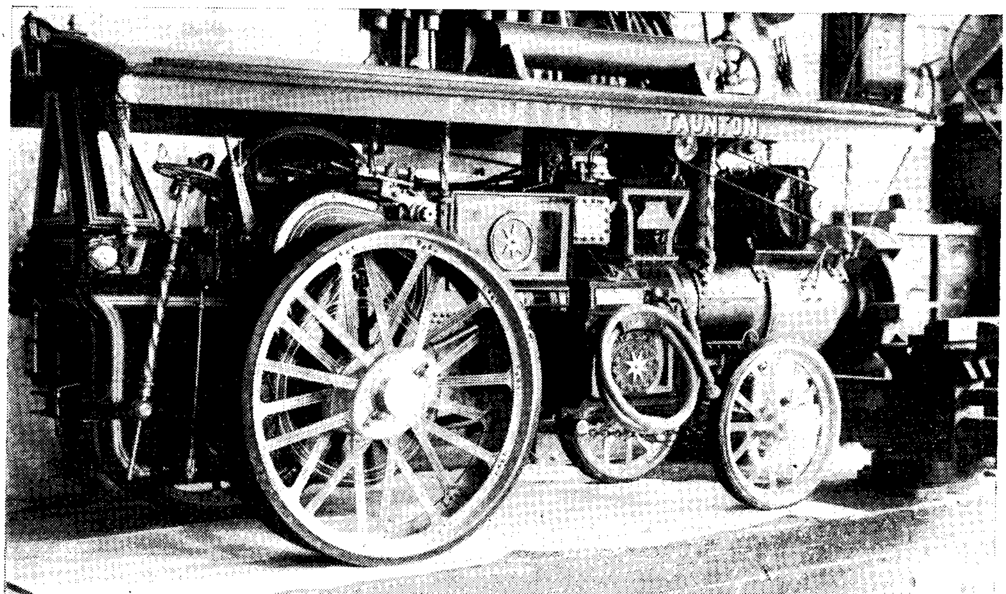


Crankshaft and gear assembly

$1\frac{1}{4}$ in. $\times$ $\frac{5}{8}$ in. section. The front wheels have 12 spokes while the back ones have 20. The hubs are gunmetal castings in the usual three pieces.

The pump was made exactly to the Burrell type and was built up and silver-soldered to fit the water-ways correctly. On many engines, the pumps are gear-driven ; but I found the gear-driven pump did not supply enough water, so I fitted a direct drive.

The change-speed gear is arranged with two levers on the three-speed models, but on two-speed models only one is used. It will be noticed that one lever operates the low and intermediate gears, as the high speed has a lever of its own. If either of the other gears is engaged, the tongues on the sides of the levers prevent others being engaged. When making this in model form, adjustments have to be made to suit it. The intermediate gear also prevents its being engaged by sliding into the low gear pinion. A bar covers the two levers (not shown) and the pins are screwed

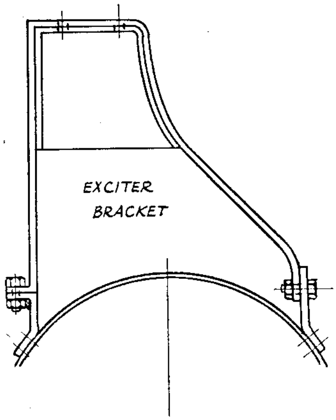


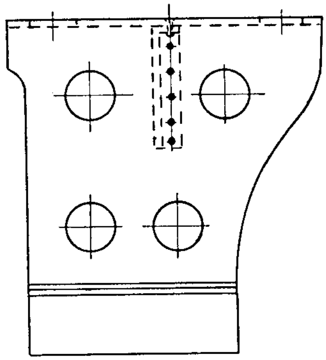
in, not, as in some cases, pushed in. To finish the transmission, guards are made to cover all this, and the hours of work are hidden from anyone wishing to look at it.

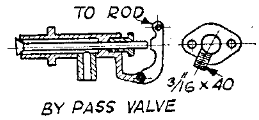
The tender, belly-tank, and steering-gear are clearly shown on the drawings. The tender is 16-s.w.g. and the belly tank is 18-s.w.g. brass. The tender, which is fixed on with $\frac{1}{8}$-in. nuts and bolts, is exactly the same width as the boiler and must line up with it.

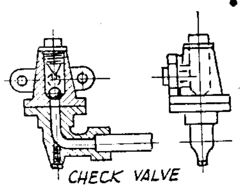
The boarding for the canopy or hood, as shown

R.A.F. rotary converter, thinking the low-voltage commutator would be useful again, with the stampings. These machines are extremely well made and it was hard to remove the windings. The commutator was taken off and the rest put into the fire to burn the insulation. A new shaft was now turned and an entirely new armature was made. The commutator, however, would not take the bigger wire, so a new 26-part commutator was also built. This was at last ready for winding, and for this purpose No. 28 wire was used. A







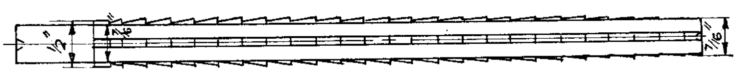


in the section, is $\frac{5}{8}$ in. wide and $\frac{1}{16}$ in. thick. Note the extra size where the brass columns come up. These are made of $\frac{1}{4}$-in. square brass twisted, finished at both ends with brass formed knobs, drilled and tapped $\frac{1}{8}$-in. Whit. Cap-nuts are used on the bottom ends to pull up to the different supporting brackets.

These engines were travelling generating-stations besides pulling heavy loads on the road. They had little rest at journeys end, but often harder work to do than when travelling. The electrical installation was interesting, as it was a miniature copy of the Central station, on the

field carcase now had to be made, as I was determined to get this all correct even if it took months of work to build. A piece of mild-steel $3\frac{1}{2}$ in. diameter by 2 in. wide was used, and the entire field and yoke was machined from the solid. It was not too difficult!

Patterns and castings were made of the ends, which were of aluminium alloy, and both were of the same design. The sizes, etc., are shown on the drawings. When tested, these worked well and gave an output of 25 watts and 5 at about 2,000 revs. It must be remembered that if a generator is to work at low speed it must be

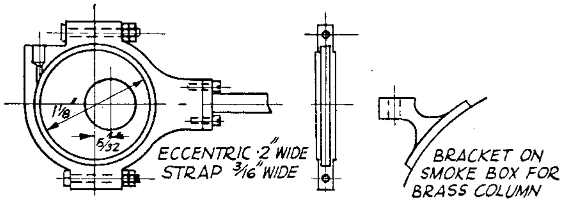


BROACH FOR CRANKSHAFT GEARS

d.c. principle. The cylinder-block was put against the boiler to make room for a small generator, called and used as an exciter. Its purpose was to supply current to the shunt field of the main generator. On some engines, the showman had altered the main generator to a compound-wound machine and used the exciter for a small outside load, while others had not used it at all. Whatever way it was worked, the power to drive it was taken through the armature-shaft of the main generator. A motor had to be bought, as it was difficult to fine one near scale size with a double shaft suitable to fit in. It was also difficult to obtain stampings of about $1\frac{1}{2}$ in. or $1\frac{5}{8}$ in. diameter to build up, but at last I acquired an

wound with smaller wire to get a larger number of turns on the armature, to keep up the desired voltage at that speed. It must also be realised that the current will not be large with the small wire, but it is used to keep the engine revs. at a more realistic speed. It was not intended to aim at a large output but to have the works and scale correct. The exciter armature is only $1\frac{1}{8}$ in. diameter but she generated very well, giving 5 volts, 1 amp. The outside diameter of the carcase was $2\frac{1}{8}$ in.

The fire grate is made in the usual way, in one piece, but the outside bars are carried down $\frac{3}{4}$ in. below the bottom of the bars and stand on the ashpan. On dropping the ashpan, the grate can



be completely cleaned out and, if oil firing is used, this will not be wanted. It is no easy job to fire this type of engine with coal, so oil is preferred. In either case, however, one must experiment with the exhaust-pipe nipple. A liner down the chimney is an advantage with compounds, as there is little exhaust.

Such things as lamps, nameplates, etc., must be left to the builder. The engine should be put through a complete steam trial, and if, when all is satisfactory, no leaks are found, and everything connected with the boiler and its fittings, and steam perfectly tight, the lagging can be put on.

The final item is the painting. Before starting this, some of the gear will have to be removed. All parts that can be removed should be, and painted separately, but before this, it must all be washed down with turps (not substitute) to remove all the oil and grease. Roughen all the parts to be painted with coarse sand-paper to give the paint a grip. I coach-paint in the old-fashioned way, but it is difficult to get the good materials today. The first two coats are priming, applied fairly thinly, and left for a day or two to dry, between each coat. For these coats, use a brush which is well worn, making sure that no brush marks are left on. Paint containing linseed oil must not be used. Gold-size and turps, with ground white lead and a little black, should be employed, and the first coat should be in the flat. When this had dried, two more coats should be given and finishing with a coat of varnish. (I believe glaze is impossible to get, at the moment, but if it can be obtained, it is better.) When the glaze or varnish is completely dry and hard, rub down well until all the shine has gone, without rubbing through. Watch the rivet-heads. When this has been completed, the striping and lettering can begin. A straight eye and a steady hand are needed. A short, fine brush should be used for this work. Mix the colour with turps, a little gold-size and varnish. If it is ground in turps at the beginning, a little linseed oil should be added to make the brush run freely. Artist colour in tubes is excellent for this work, and should be mixed as above. Leave to dry well and then add the final coat of varnish and the finished product should look very well.

It may be possible to obtain some reliable enamels from dealers in the model trade. They must be able to stand the heat. I could not obtain the colours I wanted but was lucky enough to have some pre-war materials. The showmen of today do not cover their engines with scrolls, etc., as they did years ago, and the engines can be seen. So many model engineers make their lovely engines and paint them badly. I have noticed engines with cylinder blocks in polished gunmetal! I do not paint mine to cover up bad work. I have never seen a big engine like this, and I have seen quite a number.

To conclude, I hope the information given will help model engineers, even if they are building other than Burrells, as there are many engines from which to select. For a first attempt, however, I consider it wiser to pick and engine that one knows about rather than an unknown one. I myself find the single-cylinder engines are hard to beat. The lovely bark, which is lacking in compounds, is found here. The quiet power of the compounds, however, has to be seen to be realised. I have probably left some items of interest out, as it is more than three years since some of the items were made.

Gauge "1" Tank Loco Drawings

BONDS O' EUSTON ROAD have favoured us with a set of blueprints showing general arrangement and details of a 0-6-0 steam tank locomotive for Gauge "1." As is usual with this firm's drawings, this set, which consists of four sheets, has been carefully and clearly drawn, and every detail is included.

The engine itself is of interest in that it has a spirit-fired boiler of special and novel design which, however, does not spoil the neat outline and proportions of the engine. It is internally fired, but the firebox and burner are so proportioned as to ensure satisfactory combustion, even in a high wind. The boiler has ordinary flue tubes and is fitted with one large superheater flue. In addition, there are three syphon tubes arranged in the firebox to promote adequate circulation of the water and assist in the rapid production of steam. The construction of this boiler is simple and straightforward and can be silver-soldered throughout.

The engine has two outside cylinders, the slide-valves of which are operated by slip-eccentrics mounted on the driving axle between the frames.

The backhead fittings comprise the usual water-gauge, pressure-gauge, blower and regulator, the handle of the last-mentioned projecting upwards through the cab roof to facilitate control.

One side-tank incorporates a displacement lubricator, the other a by-pass valve and union connection for the axle-driven feed-pump. The bunker is a spirit tank and is fitted with a needle valve for adjusting the flow of spirit to the burner. Castings, parts and materials for this engine are available.

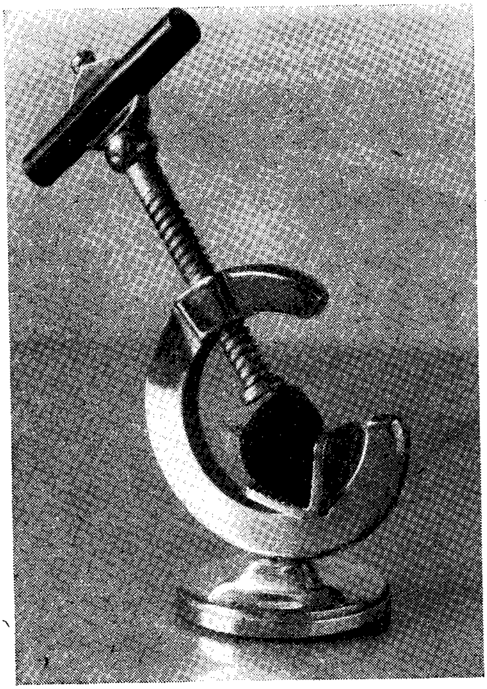


Table Nutcrackers

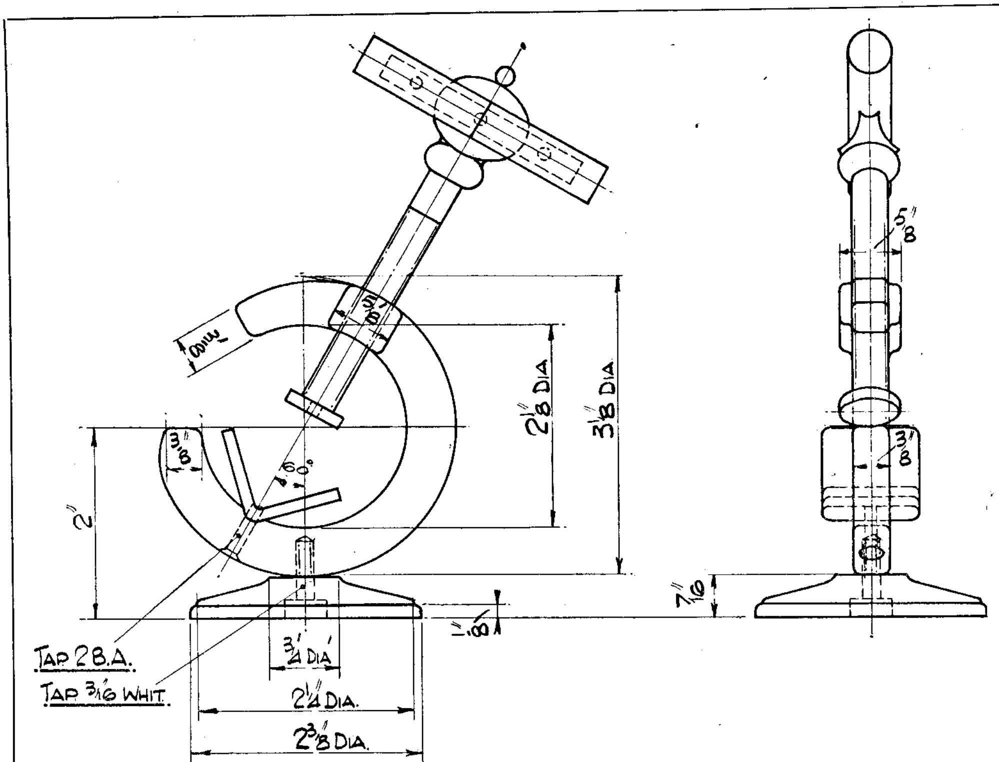
by A. Ashby

VERY soon Christmas will be here and the old problem of gifts will have to be met. The nutcracker shown in the photograph, if given a high finish or chromium plated, can be made to look quite attractive and form a novel and acceptable gift or an offer of appeasement to many of those long-suffering wives of model engineers of whom we have heard lately.

Little need be written on the making of this simple article, as the drawings and photograph explain themselves.

Cut, Cast or Forged

The body may be cut from the solid, or if a number are to be made, it could be cast in bronze or gunmetal. Another alternative would be to forge it. However, the one shown was cut from the solid. A disc of mild-steel $3\frac{1}{8}$-in. diameter, and about $\frac{5}{8}$ in. thick was turned. A $2\frac{1}{8}$-in. diameter hole was bored in it and then cut and filed to the dimensions given. In order to thread the hole in the body which takes the shaft,



Two views, showing the dimensioned details of the table nutcrackers

a taper tap was made to suit the square thread of the shaft. The making of taps has been described many times in this journal, so I do not think there is any need to repeat the various methods that may be used.

The Two-start Thread

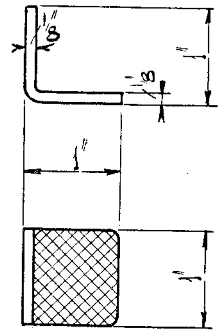
It will be noticed that the square thread has a coarse lead of $\frac{1}{4}$ in. and $\frac{1}{8}$ in. pitch and for this reason is two-start. The coarse lead enables one to open or close the jaws fairly quickly instead of having to make a large number of turns when changing from a Brazil nut, to say, a Spanish nut. On the other hand we do not want the pitch too coarse or we shall not have the leverage necessary to crack a Brazil nut.

A small spigot is turned on the end of this shaft. After plating, or on final assembly, a small disc, the face of which has been serrated with a few file cuts, is riveted on this spigot, care being taken to leave the disc loose or capable of remaining stationary while the shaft is turned round.

Handle Details

The top end or handle portion of the shaft may be finished to suit one's own ideas. I thought a black ebonite cross bar would look well with chromium plate, but as ebonite alone would not be strong enough to stand the leverage that would be put on it, some form of reinforcement is necessary. A piece of bright coloured plastic rod in place of ebonite would probably appeal to many people. The reinforcement consists of two pieces of $\frac{1}{4}$-in. diameter mild-steel rod sawn down their lengths just clear of a line across their diameter. The faces of these two pieces are cleaned up and when put together should form a true $\frac{1}{4}$-in. diameter. Having cut the small groove in them to fit and locate themselves on the wide portion of the shaft, they may be riveted on with three or four small countersunk rivets.

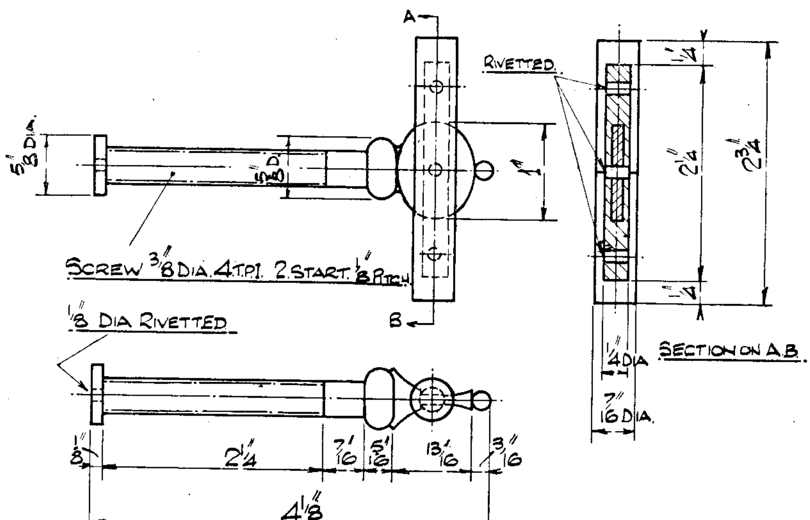
Two pieces of ebonite which have been drilled out rather smaller than the diameter of the riveted pieces are warmed to make them pliable. It is as well also to warm the metal. These pieces of ebonite may then be pushed on from each end to make them meet in the centre. When



The angle-piece for supporting the nuts

cold, they will be a tight fit and may then be polished with fine emery cloth and finally finished with metal polish.

The angle-piece which supports the nuts to be cracked may be a short piece of angle metal with a few serrations filed on the inner faces. And finally, do not forget to stick a piece of thin felt on the base to prevent it scratching that polished table or sideboard.



Details of the shaft and handle

Mystery on the Southern

A Christmas Ghost Story

by "L.B.S.C."

THE enginemen's new lobby at the Nine Elms depot of the Southern Railway presented an animated scene on an afternoon in the second week of December, 1983. "Lobby" was hardly the right word for it; it was as different as chalk from cheese, compared with the old-time lobbies, usually a shanty in the yard, with bare forms, wooden tables, and a "Tortoise" stove in the middle for burning coke. Locomotivemen, however, still clung to their old terms, so "lobby" it was. A new block of office buildings had been erected, and the big room on the ground floor had been allocated to the enginemen. It had fluorescent lighting, separate round white-topped tables, comfortable chairs with stuffed leather seats, and half-a-dozen wall desks where the drivers could fill out their report cards in comfort. On the wall was a large "showcase" with glass front, in which were exhibited all the notices about special traffic, permanent way and engineering works, signalling alterations, and so on. Adjoining the lobby was a well-equipped washroom and lavatory with lockers, so that enginemen coming off duty, could have a hot-water wash, leave their overalls in a locker, and "go 'ome like City clurks," as a Cockney fireman put it. The railways were prospering exceedingly, having (as we already know) reverted to company working over twenty years ago. The world was at peace. Children of all countries who had suffered in the war of 1939-45, and the years of austerity, crippling taxation, and "planning," that followed it, had vowed that when they grew up and took control, there would be no more of it; and they had kept their word. All the available energy was now put into making the world a fine place to live in; armies had been disbanded, and guns, tanks, bombers and fighters were just unpleasant memories. People of any country could come and go, buy and sell, without let or hindrance; bankers had solved the money problems by adopting a universal currency. Crime had practically disappeared; there was no incentive for it in a world where there was abundance for everybody. In short, "everything in the garden was lovely."

The lobby door swung open, and Driver Jack Busby and Fireman Fred Matthews came in. Jack placed his tommy-bag and tea-bottle on one of the tables, passed a friendly greeting to a couple of his cronies, and then, addressing "the company assembled" in general, said: "Well, chaps, I've seen her." The buzz of conversation stopped, and a young fireman inquired, "Seen who, Jack—the new film star?" Jack laughed. "That's all you think about! What I saw, was Sir Roy's new 'un."

"You didn't, Murdoch," chipped in Driver Horne, imitating the voice and style of his radio namesake of 35 years ago. "I did, sir, and I don't *think*, I'm *sure*," replied Jack, playing up to his colleague's lead. Jack was immediately bombarded with questions, and answered them all at once by telling the story of the incident.

The "New 'un"

The spring of 1982 had seen the debut of the "Lady" class three-cylinder 4-6-2's on the Southern. Designed by the C.M.E., Sir Roy Donalot, and incorporating improvements such as separate piston-valves for admission and exhaust, Holcrofts' final design of valve-gear, and many minor new features, the first engine, *Lady Vera*, had smashed all existing records on the first run she made with the one-hour Victoria-Dover Marine "Golden Arrow." It only needed a few weeks' running to demonstrate the outstanding success of the design; and further batches of the same type had been immediately put in hand for service on all sections of the Southern Railway. However, Sir Roy was not quite satisfied. A brilliant locomotive engineer, who had started from the bottom of the ladder, and reached the top by sheer merit, he was ever seeking improvements; and as *Lady Vera* herself had been specially designed to clear the limited load gauge on the Eastern section, whilst there was "more room to play in" on the Western section, he had got out the design for a four-cylinder version of the same type, but with a longer firebox, and a trailing bogie, in place of the pony truck. Eastleigh Works, which provided the Western section with motive power, had been busy building the first of the type, but there had been a certain amount of secrecy attached to it, for the following reasons.

The old competitive spirit of friendly rivalry had been revived, and the Southern were in honest-to-goodness competition with the Great Western, their next-door neighbours, for the West of England traffic. Swindon and Eastleigh vied with each other in striving their utmost to produce a type of engine that was fast, powerful and economical. The Swindon answer to *Lady Vera*—built at Ashford—was an improved *Great Bear*. The C.M.E., "Bob" Morse, whose hobby, stangely enough, was ferreting out old windmills and building small copies of them (he said it made a pleasant break to forget the "super-modern," and browse among the "super-ancient") had designed an ingenious valve-gear attachment, which flicked the valves over very rapidly and speeded up the exhaust opening; so that the "Teddies," as the enginemen called them, were hot stuff at

acceleration, and could "do the knots" in grand style. Messrs. Simpson and McInnes, of the L.N.W.R., and the Caledonian respectively, had also turned out a series of real "humdingers," and were ever on the lookout for chances of further improvement; so that it was only natural for Sir Roy to impress on the Eastleigh folk, the necessity for "keeping it dark," until such time as the first engine had run her trials. Nobody knew exactly when that would be; and such was the state of affairs when Driver Busby "astonished the natives" of the Nine Elms drivers' lobby with his announcement that he had seen her.

Jack Busby's Story

"It was like this," he said. "We hooked on to the 2.5 from Exeter, and ran to Salisbury on time, as usual. There was such a darn crowd at Salisbury that our 14 coaches wouldn't take 'em all in, so they bunged on a couple more; and by the time we got away, we were five minutes or so to the bad. The extra coaches didn't matter a bean to *Lady Christine*; she just dug her heels in, getting away, and scattered the dust right and left when she got going. We'd picked up a couple of minutes by the time we got near Worting Junction, and we were just kidding ourselves that we'd show 'em the rounds of the kitchen between Basingstoke and Surbiton, in case any of the stop-watch merchants were aboard, when suddenly Fred bellers 'Y, Y, Jack!' just as your humble sighted the double-yellow as well. I shut off mighty quick, and eased down to about 65; and after another double yellow, we spotted the junction board all set for crossing to the relief road. This got me guessing, for there was nothing in the special traffic notice about the 2.5 running on the relief from Worting; but there it was, and we crossed over. I said to Fred, maybe somebody's had a failure, or maybe it's a cracked rail that the p-way gang's just found, or some other trouble on the main.

Anyway, as soon as we were on the relief road, we got all greens again, and I gave *Lady Christine* her head once more. She was just getting nicely into her stride, when it happened. A whistle behind us went whooo-whooo-whoo-whoo, two long and two short blasts. It had a funny eerie sound, not like one of ours at all. I said to Fred, 'What on earth's that!' and he said, 'I dunno,' and took a look back over the side. He ducked his nut back quick and said 'Jack, there's a train coming up on the main like a bat out of the warm place, she'll be passing us in a minute.' As our clock was just on the 100, and we were still gaining speed, I didn't see how that could be; but in less than half-a-minute she was passing us! Since they altered the roads to down-up-down-up, instead of two downs and two ups, there was one set of rails between us, and I got an eyeful of the engine, though it was getting dark. I couldn't see the wheels, nor the motion, she was turning 'em too darn fast; but I twigged she had a longer boiler than *Lady Christine*, and the outside cylinders were set farther back. She had 16 on; six coaches, four Pullmans, four more coaches, and two bogie vans. She must have been doing well over 2½ miles a minute. The whole bally lot sailed by as easy as kiss-your-hand; we couldn't hear how much noise she was making, on account of our own shindy, but she seemed mighty quiet. We saw her tail light disappear around the next curve, and she was gone.

"Then I had a brain wave. 'Why, gorlummy, Fred,' I said, 'it's Sir Roy's latest, on her trial run. That's why they turned us on the relief road, and that's why it wasn't in the special traffic notices. It's supposed to be a top priority secret. Take it from me, my lads, she's the berries as far as going is concerned. A few like that won't half make the G.W. sit up and take notice."

There was a buzz of comment as Jack finished his narrative; and several of the drivers and firemen asked questions about such details of the the engine as he had been able to observe. Then, as Jack went into the wash-room to have a clean-up before going home, Loco-Inspector Mills, who had come into the lobby whilst Jack was speaking, followed him in, and said, "Jack, there's something damned funny about this. You were turned on to the relief road because old Tom Spike, the ganger at Basingstoke, wanted to examine the shifting diamonds on the new crossover, they have just put in, east of the station; and Sir Roy's new engine hasn't left the shops yet. My son Alf was working on her yesterday. The 'Bournemouth Belle' went up five minutes ahead of you, on the relief road, and there was nothing booked on the main for 20 minutes afterwards. So what?"

The Mystery Deepens

In the early hours of the morning of the eighteenth of December, the 3.30 a.m. *ex*-Waterloo parcels and newspaper train was speeding along between Byfleet and Woking, when the driver saw the glow on the exhaust steam of a train coming towards him at a tremendous speed. He called to his fireman, "What's that, George—we shouldn't be meeting anything this side of Winchfield." "Likely a special parcels, seeing it's near Christmas," said George. As the engine approached, they noted with amazement that it was carrying two yellow lights and one green light on the front; there was nothing like that in the Southern destination code. "Where the dickens is it going?" said the driver. "Goodness only knows," rejoined his mate. Then it flashed by; they heard no sound, as their own engine was making the usual clatter. "It was a passenger train—I spotted four Pullmans," said the driver; and beyond remarking that maybe the strange headcode was an emergency indication of a through train to another company's line (there was a fair amount of "through" running) they thought no more about it, for the time being.

Two days later, the mysterious stranger was again seen, this time by the crew of the down Southampton boat train, just south of Mitcheldever. The driver said that it must have been doing close on 100 miles per hour, if not more, coming up the bank, the train being of the same formation, coaches, Pullmans, vans, sixteen in all. By this time, the news had spread all over the Western section, and signalmen had orders to stop any train that was not running either to

the working time-tables, or the special traffic notices; but the train eluded them. On the night of December 21st, a special from Bournemouth was booked to arrive at Waterloo at 12.35 a.m., after the regular traffic had ceased. A train was signalled through Vauxhall, passed the automatics, and pulled into the platform which had been cleared for the special. The few passengers who alighted, seemed to flit away unnoticed. A shunting engine pulled the empties out, and put them in No. 4 siding. The engine followed, apparently going to Nine Elms sheds. But no engine arrived at Nine Elms, and No. 4 siding was unoccupied when the day shift arrived. Meantime, the Waterloo signalman was astounded when a *second* special was announced from Vauxhall; this proved to be the one which was booked in the special traffic notice, and carried a goodly and noisy crowd of returning day-trippers.

The L. & N.W.R. Gets a Shock

One of the new Simpson-designed "simple-compounds" of the L.N.W.R., similar to the modern 4-6-4 *Jeanie Deans*, which was previously described in these records, was hauling the 2.0 p.m. from Euston to Glasgow, in charge of Driver Bill Proctor and Fireman Bert Hobbs. She had eighteen on, and was steaming up the grade between Boxmoor and Berkhamsted at a steady 85 miles per hour. Bill said to Bert: "Old *Jeanie* was a good 'un, but this is better still. She'd take some catching." Bert replied in his delightful Cockney lingo: "Blimey, not 'arf, she wouldn't! Bill, I s'pose you've 'eard abaht that noo 'un they got on the Souvern. Gorlummy, it'd be a blinkin' scream if we could 'ave a dust-up wiv 'er." Hardly were the words out of his mouth when "Whoooo-whoooo-whoo-whoo!" came from behind the train. "Wot the 'ell's that?" said Bert. "Blest if I know," rejoined Bill, "Poke your knob out and take a dekko." Bert took one quick look back, and gasped "Blimey! I spoke too quick, it's 'er, an' she's chasin' us. I 'eard as 'ow they was goin' to run anuvver interchange trial, but fort it was a lotter ole balsam. Enny ole 'ow, 'ere she comes, an' she's a-goin' to do it on us proper!" In a few seconds, the long green-and-silver engine glided past them apparently without effort, just a silvery blur playing around her wheel centres. Bill didn't get much view from his side of the cab, as the Glasgow train was on the down main, the extreme left-hand road of the four tracks, whilst the stranger was on the down relief road, with the up main between them; but Bert got a good sight of her. He was too busy taking in her general outline, to notice her name and number, and only got a fleeting glimpse of the engine crew in the cab; but he counted the coaches, and said to Bill "Same load as us, twelve coaches, four Pullmans, two vans, eighteen altogether, so I reckons it mus' be a try-out. Cor, that injin ain't 'arf a smasher, she'll top the 'underd afore she gits over Tring, an' she'll ony want wings arter that!" He adjusted the valve of the mechanical stoker, and then looked over the side once more, only to bob his head back again with the startled exclamation "Corblimey—*she's gorn*—like a blinkin' flyin' sorcer!"

The "Skirts" Take Over

Meanwhile, Joy, neé Donalot, with her hubby and her two daughters, had been spending a week-end at Ashford with Sir Roy and Lady Vera. Whilst at tea on the Sunday afternoon, Joy suddenly said, "Listen, dad, I've got a smashing idea. You recollect that party of Russian railway engineers that we entertained at the Cannon Street Hotel. Well, the one who sat next to me—nice fellow he was, too—said he wondered why English women didn't take to locomotive work; and added with a sly grin, that maybe they were scared of big engines, or afraid of soiling their hands. He said that back home, they had plenty of Olgas and Sonias on the footplate. They are going back on the 'Golden Arrow' next Saturday. Let's give 'em the shock of their lives by running the train with a complete crew of women. I'll drive, Alice can fire, Gert and Daisy know the guard's duties pretty well, and as the Pullman Company already have hostesses on many of the cars, they can easily arrange a full muster for the 'Arrow.' What say—shall-us-let's?"

There was nothing "flighty" about this proposal. Joy was a fine woman in her late thirties, and had a keen sense of humour. She was born with engines in her blood, and as we already know, had worked for the Southern before marrying her departmental chief. She had made many footplate trips, and could handle a locomotive as well as any of the senior drivers. Alice was her sister-in-law, about two years her junior; a fine upstanding woman who had made a name in the athletic world. She also was keenly interested in locomotives, and could operate a mechanical stoker and use the injectors. Gert and Daisy were married twins and Joy's cousins; their "mum" had done duty as a guard on the Southern Electric during the Hitler war, and one or other of the young girls, as they were then, had often accompanied her on a turn of duty. The suggested crew of "skirts" were, therefore, staid and able women who knew the job, and would take it seriously.

Sir Roy realised this, and answered "O.K., Joy. It'll be a smashing advertisement for the 'Golden Arrow,' the G.M. will be tickled pink; and you can bet old Page, the publicity agent, will do his share. You better have *Lady Vera*, as you named her; I'll see she is in top fettle. Get your crew together, and we'll see to the rest."

By mid-week, it was known all over the country that the Saturday "Golden Arrow" would be "manned" entirely by women, and there were enough applications for reserved seats to fill half-a-dozen trains. When the Saturday morning arrived, there was such a crowd at Victoria Station that the film cameramen and press photographers had all their work cut out, to get a look-in. The Pullman Company had selected their prettiest hostesses for the cars, and they looked a picture in their smart uniforms. The train crew had banned "slacks" as unladylike, and Gert and Daisy wore dark blue skirts and tunics with silver buttons; when a press photographer asked them to pose together for a shot, Daisy said with a grin: "I'll bet this is the first photograph you've ever taken of a railway guard wearing nylons." There was a loud burst of cheering as Driver

Joy backed *Lady Vera* on to the twelve-car train, and whirring and clicking of cameras as Fireman Alice jumped down, coupled up, and called to Joy to make the brake test. The pair of enginewomen wore wrap-round overall coats, dust caps, and gloves, as used for housework, so there was nothing startling about their appearance, though they looked very "businesslike." The Russian contingent were amazed at first; but when the one who had spoken to Joy at the reception, recognised her on the footplate, he "put two-and-two together," in a manner of speaking, and informed his colleagues.

The train loaded up; right on the "dot," Gert waved her flag, and Joy opened the regulator. *Lady Vera* made a perfect start, accelerated up the climb to the river bridge in her usual manner, and as Alice started the exhaust injector and adjusted the valve of the stoker engine for a steady feed, Joy notched up, and the engine settled to a steady 70/75 through the suburban area. There were crowds at Herne Hill and other suburban stations, to see the "all-female" train go by; and everything was going fine until they were approaching Beckenham, when Joy exclaimed "Oh, blow!" opened the blower, slammed the regulator shut, and grabbed the whistle cord. Two yellows! Joy made a slight brake application as the next signal also showed double-yellow; but when they sighted Shortlands Junction, the lights were green, so Joy released her brake and opened up again. Then a strange thing happened. As *Lady Vera* accelerated past the junction where the Catford loop joins the main line, another train appeared. This was accelerating, too, apparently having got a double yellow at Ravensbourne. The two engines came side by side on the parallel lines, and the driver and fireman of the newcomer both looked over at Joy's engine, blew a crow on their chime whistle, and waved to her. Joy was too intent on "dogging the boards" for Bromley South to do more than give a casual wave back, whilst Alice tooted the whistle in response. They cleared the station, still accelerating. Joy spotted the next green light, then suddenly called out, "Alice, where's that other train gone? It never stopped at Bromley, but I don't see it now." Alice crossed over to Joy's side of the cab, looked up and down the line, and said "It's gone, sure enough, but *where*, goodness only knows! It didn't drop behind, and it couldn't have picked up speed quick enough to get out of sight so soon. It's got me beat!"

They were now about a minute down on schedule, owing to the slack, so Joy and Alice concentrated all their attention on regaining it, and soon forgot the mysterious disappearance of the Catford loop train. The rest of the run was uneventful. Ashford Works staff turned out *en masse* to give Joy and Alice a cheer (which they never heard!) as they flew past at over two miles per minute; and Joy made a perfect stop at Dover Marine in a few seconds under the hour. The Russian engineers crowded around to shake hands with her, and congratulate her on a fine run; and Joy, Alice, Gert, and Daisy, had to pose for photographs alongside *Lady Vera's* cab. Incidentally, Joy nearly blew up when she saw the picture in the Sunday newspaper, and found she hadn't wiped a black smut off the tip of her nose!

Joy and her family spent the week-end again at their parents' home; and discussing the trip, Sir Roy said: "What made you slack at Shortlands, Joy? We took good care to give you a clear road." Joy stared in surprise. "Why," she said, "I got two Y's both before and after Beckenham. The train that came off the Catford loop must have got them too, at Ravensbourne, for they came alongside us at the junction." "But there was nothing coming off the Catford loop till five minutes after the 'Arrow' passed! Even then, it was only an electric for Sevenoaks. I can't understand this at all," said Sir Roy. "Neither could we," replied Joy "for now you mention that, the darned train disappeared so suddenly that neither Alice nor me saw it go, or where it went to."

The Solution of the Mystery

It was late afternoon on Christmas Eve. The first of the new "Queen" class *Queen Anne*, had been out for a preliminary spin from Eastleigh to Bournemouth and back, in charge of Driver John Barlow and Fireman Pat Clancey. Sir Roy had accompanied them. All three, with a locomotive inspector, and the Eastleigh Works Manager, were looking over the engine in the yard, when the shed foreman came hurrying up. "Sorry to interrupt," he said, "but the engine booked to take the Southampton boat train to Waterloo, has just burst a tube. We haven't another engine ready, so I was wondering if Sir Roy would care to let the new *Queen Anne* take the train up. It will save delay, and make a good test." "Just what the doctor ordered," said Johnny Barlow. "May we, Sir Roy?" "Shure an' o'id love it," added Pat, "Do let's go!" "O.K." said Sir Roy, "I'll ride with you. Fill her up quick, and let's get down to the dock station."

Queen Anne, still in her shop dress of battleship grey, backed on to the 18-coach boat train; and when the right-away was given, slowly threaded her way through the dock lines, over the street crossings, and finally got out on to the up main line, where she at once began to give evidence of her power and speed. As she, like the "Ladies," had ball and roller bearings throughout, there was nothing to run hot; so Johnny let her out until the speedometer registered just over 100 m.p.h. The boat trains were now timed to run from Southampton Docks to Waterloo in the level hour, same as the "Golden Arrow," so there wasn't much time to go to sleep by the wayside. There was a permanent-way slack at Winchester which brought speed down to 40 miles per hour, but after that, *Queen Anne* accelerated to 90 up the long drag to Worting Junction, where the West of England line comes in. She passed the junction well up to schedule; and though there is a "galloping ground" between that point and Surbiton, there was no need to exceed about 110 m.p.h. to land at Waterloo "on the advertised." Johnny Barlow notched up to 15 per cent. cut-off, adjusted the separate exhaust for early release, and the train sped merrily along at

just under the two miles per minute; she had just passed Fleet, when IT happened.

Pat, taking a quick look over the side at the injector overflow, glanced back, and then called out "Howly St. Pathrick, there's a thrain chasing us on the relief road, an' begob she's steppin' on it!" Sir Roy looked back, saw what Pat had seen, and turned to the driver and said "Johnny, I think we are going to solve a mystery. Give her all she's got!" Barlow promptly did so. "Don't risk anything—watch the lights," added Sir Roy. "Pat, keep the stoker and injector going, to give Johnny all the steam he needs. I want a good look at the engine of this train; it's not one of ours, and there's nothing booked so close to our timing." *Queen Anne* was now accelerating like nobody's business; still the other train was catching up. Suddenly "whoooo-whooo-whoo-whoo!" came the sound of her chime whistle. Sir Roy's face went pale as his mind flashed back to the first run of *Lady Vera* on the "Golden Arrow"; he had heard the same signal as the train was approaching Ashford, but the fireman swore that he had never blown it. He slid back the cab window just far enough to look out again. The train on the relief road had caught them; the engine was already passing the boat train coaches, despite the fact that *Queen Anne's* speedometer needle had passed the 150 mark. As the engine drew level, Sir Roy noted that she was a long green 4-6-2 with the outside cylinders set well back; had a short wide stovepipe chimney, a boiler about the same size as *Queen Anne's*, and a high-sided six-wheeled tender. The driving wheels were turning so fast that the motion was just a blur, it was impossible to see what type it was. She was running as steady as a rock, apparently making no noise, although their own train was making such a rattle and clatter at the high speed, that it might possibly have drowned any nosie that the other train was making. The engine was passing so quickly, that Sir Roy only had a matter of seconds to take it all in. As the cabs drew level, there was a cheery "Whoo-whoo!" from the stranger's whistle, and the driver leaned right out and waved to Sir Roy, despite the rush of air. Sir Roy only just managed to get the engine's name and number; but as he waved back, he got a full view of the driver's face.

The engine passed on, and was followed by sixteen Pullman cars, brilliantly lighted, and crowded with passengers, men, women, children, all with happy smiling faces, some of them looking out with interest at the boat train which they were just passing. As the last car passed *Queen Anne's* cab, Sir Roy glanced at the name board over the cornice. He was white and trembling as he said to the driver "Ease her up, Johnny, I've found out all I wanted to know." John Barlow shut the regulator; and, then, as the other train drew ahead, there was what appeared to be a terrific flash of lightning, which momentarily dazzled all three men on the footplate. When they recovered their sight, the other train had completely vanished. Nobody ever saw it again.

The boat train arrived at Waterloo on time; and Sir Roy, after telling John and Pat to stable *Queen Anne* at Nine Elms for the night, and take her back "light" in the morning caught the next train home to Ashford. As soon as Lady Vera saw him, she exclaimed, "Why, Roy, whatever's the matter—you look as though you'd seen a ghost!" "I have," he replied. "The boat engine broke down, and we brought the train up with *Queen Anne.* We were going like blazes between Fleet and Farnborough, when that mysterious train caught us up and passed us. She must have been doing well over three miles a minute. I just got the engine's name, and the driver blew a greeting, leaned out, and waved. She went past, got ahead, and literally disappeared in a flash."

"You say you got the engine's name? What was it—and did you recognise the driver?" said Lady Vera. A lump came into Sir Roy's throat, and his voice broke as he replied "Vera, my dear, the engine's name was *Tugboat Annie.* and the driver was our old friend Curly."

Lathe Accuracy

J. A. Kershaw writes:—"Some weeks ago, you printed a short note on the inaccuracy of small lathes, and as you rightly stated, also to be found in larger machines.

As testing lathes, and the fitting of chucks, take up quite a lot of my time, I should like to quote an instance that occurred quite recently.

A customer bought a small lathe, six months ago, and it performed quite well, until he decided to fit a self-centring chuck. After many attempts, the backplate was the thickness of a wafer, but the chuck would not run true, so he arrived at the conclusion that the spindle nose was out of true. These were returned to the works, where the spindle was checked and *found correct.*

Next, I examined the backplate register, and observed that there were four small particles of brass turnings embedded on the face; next, the securing screws were checked, and I found that two holes in the backplate, corresponded with two in the chuck, but the third was 1/64 in. out. Then came the spigot again, there was 1/64 in. of slop in the chuck housing, and the spigot had never had the corners taken cleanly out. Next, the chuck, a good make, but obviously not new, for again each jaw could be moved nearly $\frac{1}{16}$ in. Taking all these into consideration, the chuck would never be true in a thousand years.

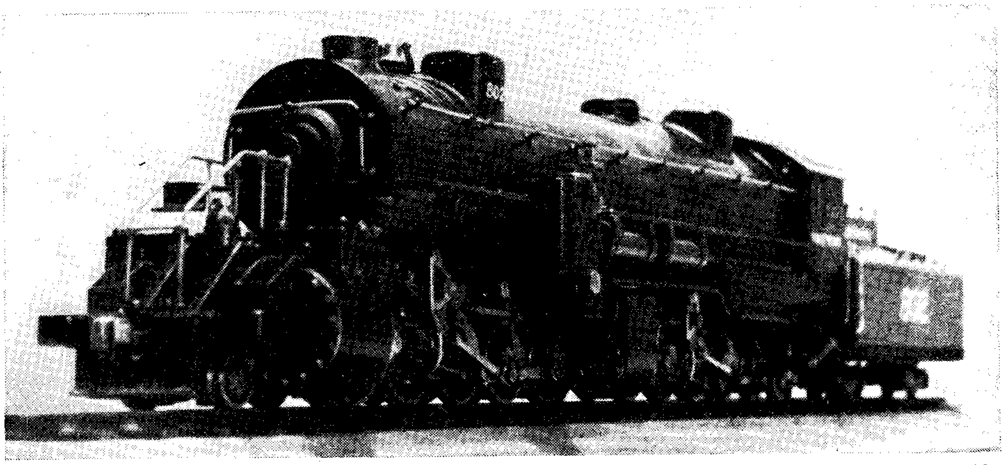
Finally, if any readers would apply to the chuck manufacturers, I am sure they would be pleased to supply directions for chuck mounting.

So, next time, all you modellers, don't jump on the machine, first time, do a bit of checking up. After all, everyone has 'teething trouble'."

A "OO" Gauge Mallet Locomotive

by A. A. Sherwood

AFTER considerable experiments with very small steam plants, I had a desire to produce something as close to the prototype as practicable in "OO" gauge. Since I also hoped to obtain as powerful a locomotive as possible, I turned to American locomotive practice. The colossal dimensions of the Virginian Railroad, 2-10-10-2 Mallet compound decided my choice. A former edition of *The Locomotive Cyclopaedia* provided very full information; it is a pity that nothing to compare with this publication seems to exist on British Railway practice.



A three-quarter view of the finished locomotive. (The camera was as close as possible without trouble from depth of focus)

The outline of the locomotive was drawn to a scale of 0.138 in. to a foot, and it could be seen at once what an enormous machine it would be by comparison with some blueprints of British locomotives for the same gauge. The prototype had low pressure cylinders, 48-in. bore and the maximum boiler diameter was about 10 ft.! Tractive effort (maximum) was 175,000 lb., and it has been credited with shifting a 17,000 ton train unaided.

The design of the model involved the solution of many problems; the most important at the start was the articulation of frames and steam connections. Drawings were made twice full size (of the model, naturally) to check on all the clearances and make the best use of the available space.

Articulation Pivot

The pivot is formed integral with the high-pressure cylinder block, which straddles the frames. This is hollow, and supplies steam to the receiver, leakage being avoided by the normal type of packed gland. Thus the single joint replaces the two ball-joints and telescopic tube of the prototype. The receiver passes under the axles of the front motor group. This entails a long receiver, and consequent condensation losses; but I could see no practical alternative; at least in this size of model.

Boiler Feed Pump

This must, for obvious reasons, be driven from the axles of the fixed motor group. The only available space was between the frames under the cab; this entailed special design of the trailing pony truck to avoid fouling the pump. The drive is from an eccentric on the rear coupled axle.

Springing

Due to the small size of the driving wheels and little depth of frames, there was no room to fit the usual coil springing system of model locomotives. The equalised system on the prototype had to be used, with coil springs instead of leaf springs between the axleboxes. The diagram of the spring rigging shows the two types of equaliser used; the crescent shaped ones are used where headroom is rectricted, i.e., under the firebox.

Exhaust Connection

The two ball-joints and telescopic tube of the prototype was used here; but no packing is required. The balls are held to their seatings by springs, as shown in the diagram.

Lubrication

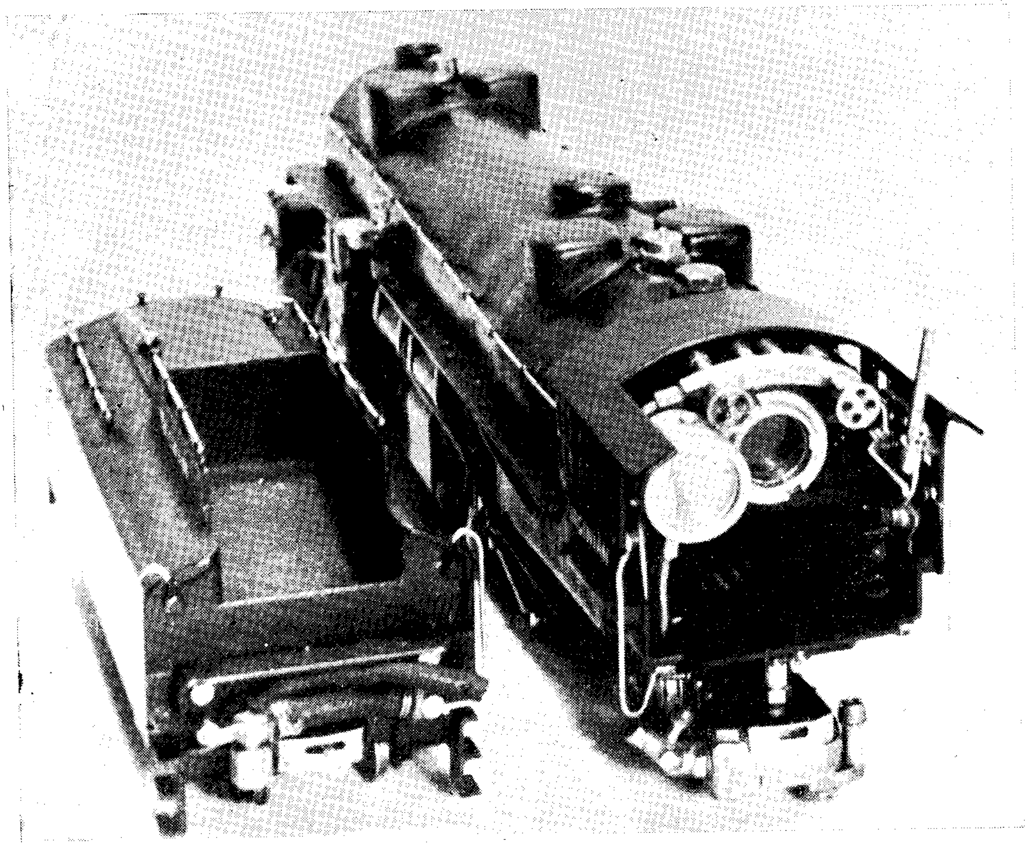
The Worthington feedwater heater and pump of the prototype was copied externally; but in the model it serves as an oil reservoir and houses

an oscillating oil pump driven by ratchet gear from the h.p. group expansion-link ; the ratchet gear is out of sight between the boiler and the oil reservoir. There is also a displacement lubricator for emergency use, which replaces the air reservoir on the right hand side of the model. Each may be isolated by screw-down valves.

careful "wangling," it was found possible to avoid this trouble by cutting clearances for the cylinder flanges only, each side frame remaining in one piece.

Commencement of Construction

The aforementioned problems having been solved (at least on the drawing board) construction commenced with the driving wheels. These were forged from mild-steel bar using a die to form the spokes, balance-weight and crank bosses. I found this method of manufacture saved a tremendous amount of time ; in fact, the whole twenty drivers were finish-machined completely in a working time of about 40 hours, starting from stock metal. The main frames were cut from 3/32-in. gauge plate, which may sound thick, but in actual fact is very close to scale thickness for the bar frames of this locomotive. The coupled axles are 5/32 in. diameter running in phosphor-bronze axle-boxes. The driving axles are the same size, but hardened, ground and lapped ; they run in hardened steel bushes in "tied" axleboxes (i.e., both axleboxes formed in one piece, so that they remain



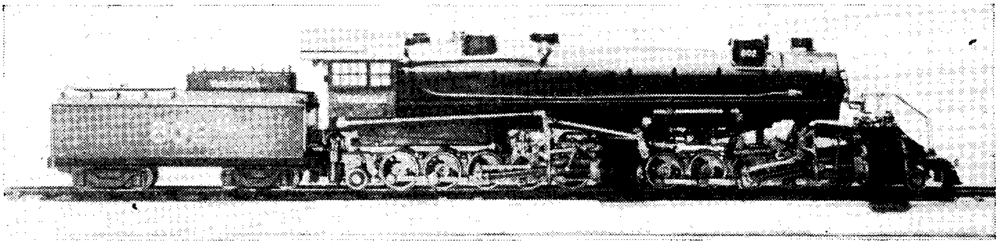
View of cab and front end of tender, showing cab fittings, firehole door open and water connections

Simple and Compound Operation

The original design included a valve for changing from simple to compound operation and vice-versa, as on the prototype. This valve is shown in the diagram of the articulation pivot in the "compound" position. Subsequent events, however, led to the rejection of this valve after the first few tests in steam.

Attachment of L.P. Cylinders

On the prototype, these are so enormous that the frames are divided to clear them, one section passing under the cylinder block, and the other over the same. Even with a 12-ft. loading-gauge width, the cylinders would otherwise foul the frames. On the model, the frames are slightly closer together than scale dimensions ; by



Left-hand side view

in alignment). This is not a feature of the prototype, but is usual in present-day practice, especially where roller bearings are used. I felt that any wear on these axles would be fatal to valve events, as wear on models of this size is out of all "scale" proportions, unless special precautions are taken. The frames were assembled, and the wheels were pressed on the axles in a jig to ensure correct "quartering," and at last, the "shape of things to come" began to be realised.

Spring Rigging

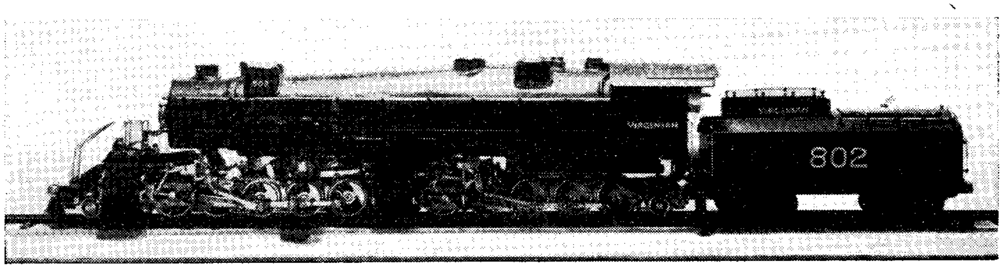
The diagram shows part of the spring rigging details of the parts used; the whole of the rigging is in stainless steel, except the coil springs, which are of 30-gauge piano-wire. This was the most tedious part of the job, involving much repetition work; unless one looks carefully for it, however, it remains out of sight behind the coupled wheels.

Motion Work

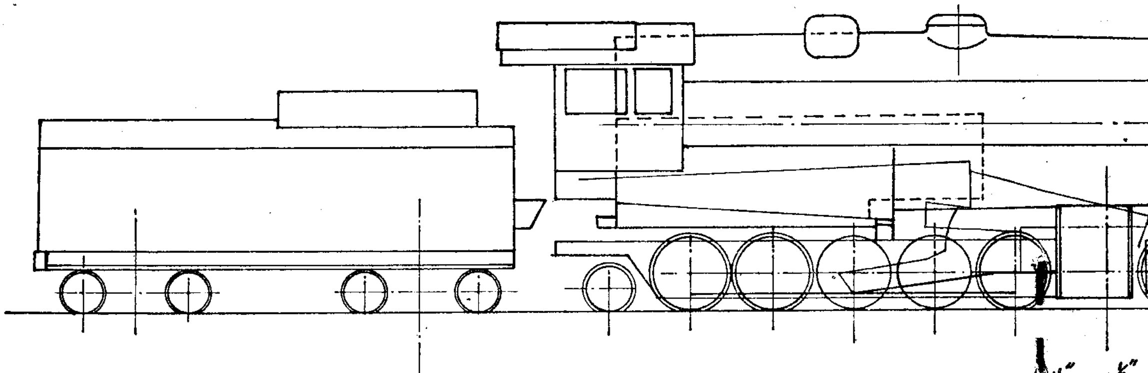
All coupling-rods, connecting-rods, and valve-gear are made of stainless steel, with hardened bushes and pins, except the main bushes running on the driving crankpins; these are of phosphor-bronze. Particular care was taken to avoid the appearance of excessive "weight" in the valve-gear, despite the unavoidable use of grossly oversize pins. The position of return cranks (i.e., all leading the main crankpins) on the prototype was adhered to; hence, with the model, all radius-rods are at the lower end of the expansion links in forward gear. In the prototype, the h.p. radius-rods are at the top of the links in forward gear, since the full size h.p. cylinders have internal admission piston-valves, and the l.p. cylinders slide valves. The motion-plates are fabricated from stainless steel plate, using silver-solder for joints, and are a close copy of the steel castings used on the prototype. The crossheads are also of stainless steel, and form a complete "box-section" to receive the small ends. It was found necessary to offset the h.p. guide-bars slightly to clear the coupling rods.

Cylinders

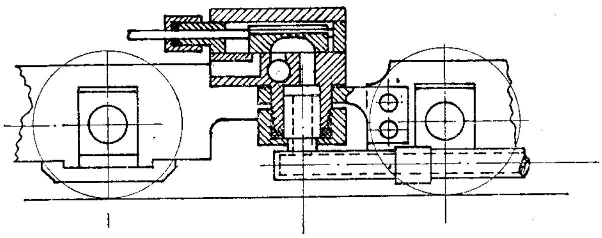
The h.p. cylinder block was built up in brass, the block for the portfaces stretching right across the frames, and has the ports for the simpling-valve also cut in it. The steamchests and cover are also in one piece, the boiler saddle being bolted to the cover. The l.p. cylinders are each separate, and also built up in brass; the l.p. steamchests are permanently joined by the steam and exhaust pipes silver-soldered to each. All cylinder bores and port-faces were chromium faced and lapped. The chromium facing of the h.p. cylinders, I think, can be regarded as quite an achievement, for which I have to thank Messrs. Fescol. Even the l.p. bores were reckoned to be the smallest size which can be satisfactorily chromium faced. The cylinder heads are of stainless steel, and are held in position by 0.8 mm. studs and nuts. The slide-valves are of bronze, with hot-punched cavities, the exterior being machined after punching. The ports were cut with a special "gang mill"; provided that the diameter of cutters is worked out properly, the usual complaint that this method gives ports too shallow at the ends is quite unfounded; the square corners of ports formed by this method are a joy to behold, and the actual cutting is a matter of seconds. The pistons are of stainless steel, with a very deep groove for soft packing.



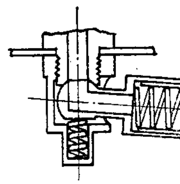
Right-hand side view



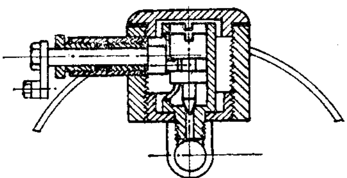
LINE DRAWING OF MODEL.



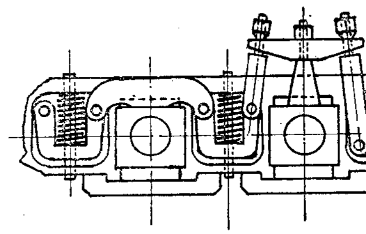
ARTICULATION PIVOT.



L.P. EXHAUST



REGULATOR.



SPRING RIG

Completion of Chassis

The only further items to complete the chassis were then the boiler support (at front of firebox), the sliding support on the l.p. frames and the pilot beam, pilot and drawbar. The sliding support is quite a complicated shape, as the bearings for the reverse shafts of the valve-gear are integral with same. At this stage, the chassis was tested on compressed air with very encouraging results.

The Boiler

This was the item that I expected to give trouble ; and it certainly did ! The first attempt was fitted with two ¼-in. superheater flues, five $\frac{3}{16}$-in. tubes and a combustion chamber. The water-gauge was made as shown on the l.h. side of the appropriately labelled diagram. On test, results were fair, and steam was raised on a coal fire. The blast required was excessive, and the fire was rather uncontrollable, either burning too fiercely or else going out on the slightest provocation. After many experiments with this boiler, I decided to build a new one in the light of experience.

The new boiler itself was identical, except for altering the tubes to ¼ in. diameter and fitting only one superheater flue, of $\frac{5}{16}$ in. diameter, the usual type of firehole ring was discarded and instead, the firehole opening made the same width as the inner firebox and " bottomless "—in fact, almost a " dry back." I could now get at the fire with ease. The water gauge was redesigned to reduce meniscus error, and now the " window " can easily be removed complete with frame for cleaning the glass (see right-hand

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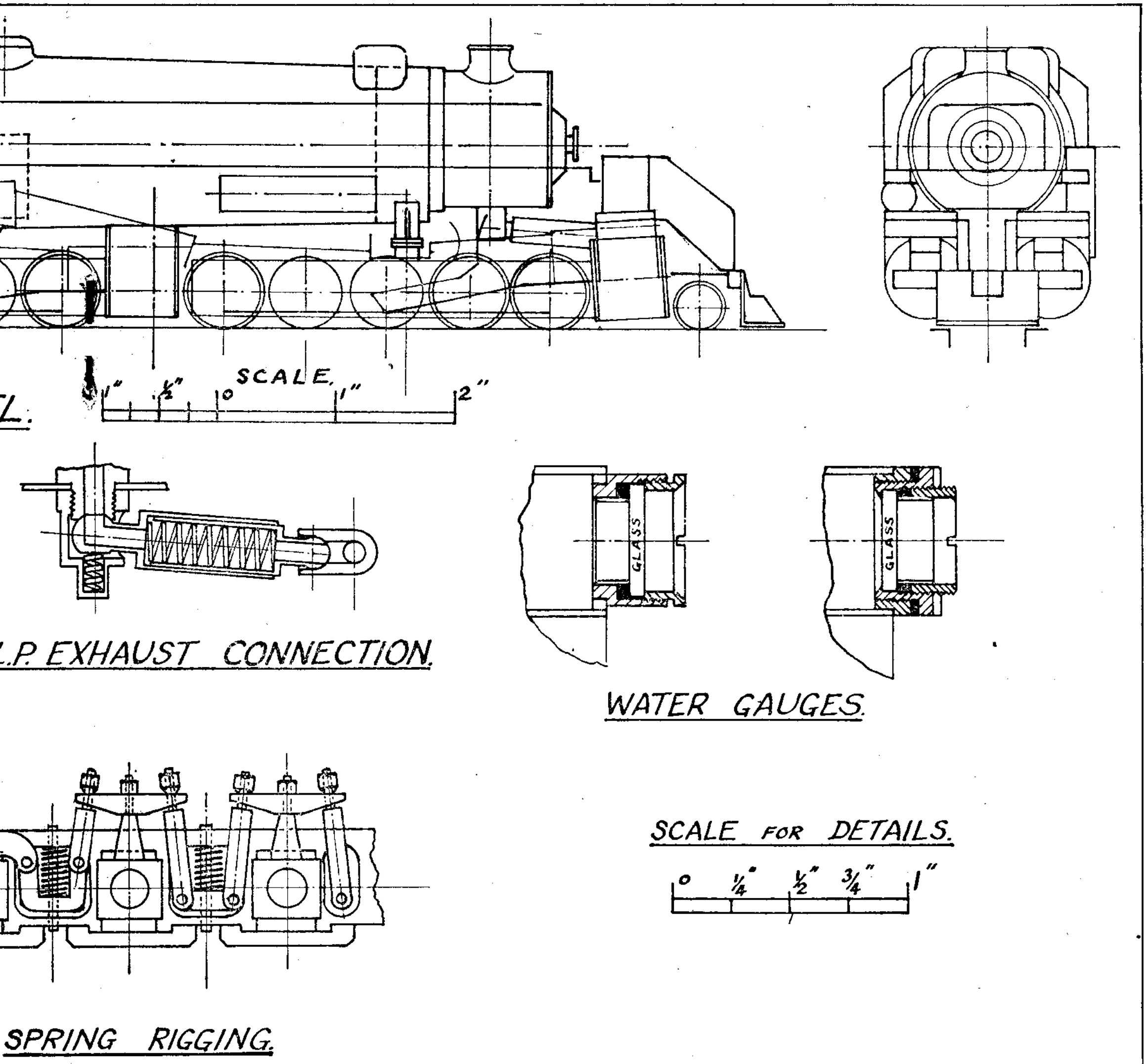


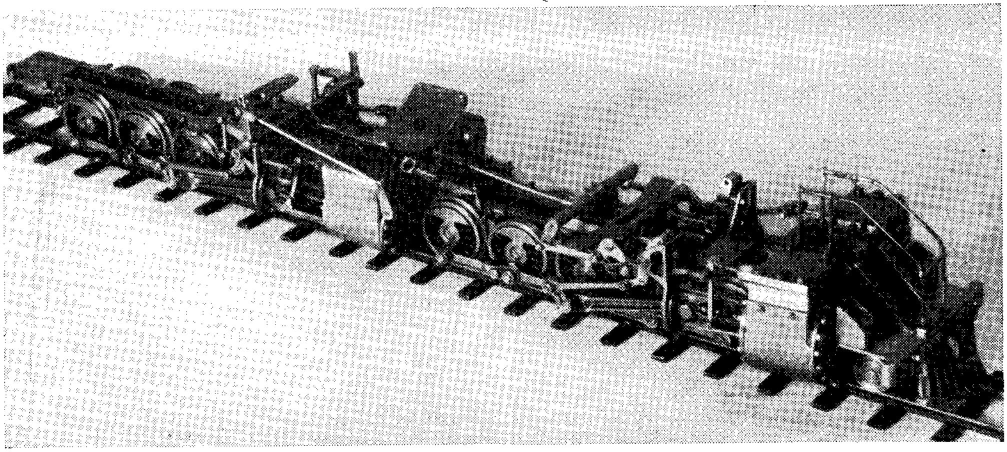
side of the diagram) without disturbing the rubber packing.

Cab Controls

The layout of controls in the cab certainly does not look realistic; they were, however, designed to work and be easy to get at with full-size fingers. The water-gauge has already been mentioned; the pressure-gauge is ½-in. diameter and reads from 0-80 lb./sq. in. The turret is fitted with two valves, one controlling the ring blower; the other is the whistle-valve. The reverse lever on the r.h. side of the cab is fitted with an extension for ease of operation (with the cab roof removed, of course). The horizontal lever is the throttle control, operating the throttle-valve in the dome by external push-pull rods. The valve shown in the diagram is the present one; a plug-cock type of valve was tried at first, and then a semi-rotary valve, but neither was successful. The present throttle really will regulate the speed down to a crawl with full boiler pressure (60 lb./sq. in.).

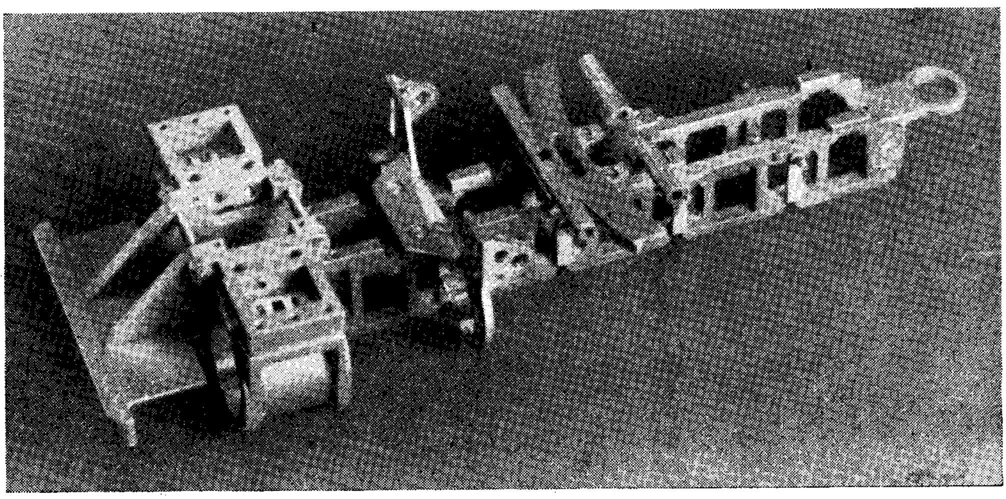
Test Runs

The first test run under steam from its own boiler was carried out on a roller stand, using a hand-pump to keep up the boiler water level, and a gas burner in the firebox. Working as a full compound on very light load, the l.p. group ran much slower than the h.p. group; the only way to get both groups running at the same speed was to load the h.p. group heavily. The h.p. group would have a heavier load when the axle driven pump was fitted; but a run on simple operation showed that, under this condition, the

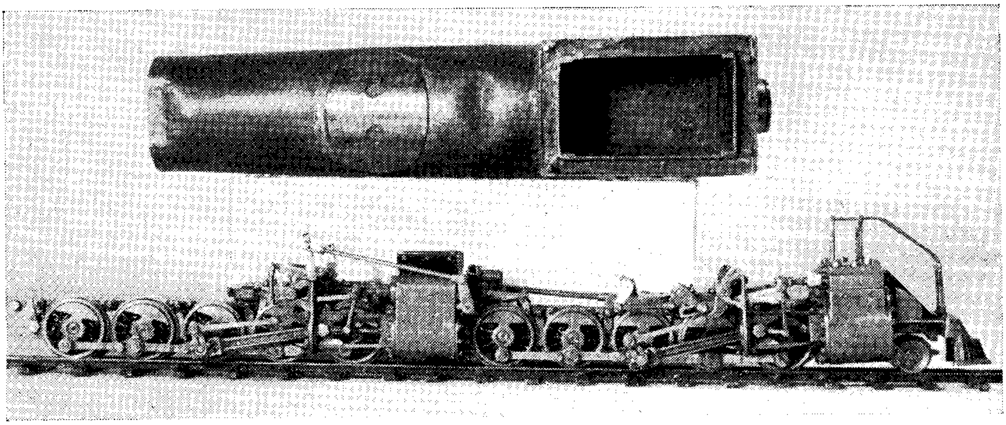


Locomotive chassis before fitting axle pump and trailing truck

"l.p." group was the one that wanted the heavier load. Even so, there would be an advantage in retaining the changeover valve for ease of discharging condensate when starting up. What was required was an adjustable bleed of h.p. steam to make up for heat loss in the receiver. In order to fit this and still retain the changeover valve, major alterations would be required; therefore, the changeover valve was discarded. the h.p. bleed valve for the receiver fitted and, also, a release valve was fitted to the front end of the receiver as an aid to condensate release on starting. The operation on the roller stand was now much improved, and the work done by each motor group could be equalised with ease. A further test was made on coal fuel and also experiments on charcoal firing were carried out; an experimental screw-feed stoker was made up in an attempt to get over the firing difficulty. In no case was complete success obtained; the fire needed attention far too often for track running; although the stoker would feed the fuel, it would not distribute it properly. Added to this there was the fouling of the combustion chamber and smokebox; no easy job to clean out on this size. Meta fuel was next tried, but the fouling was even worse; in fact, the chimney soon halved its effective area due to the white deposit of meta fuel. I very nearly decided to go over to liquid fuel; but, as a last hope, meta was tried after raising steam on a gas burner. The result was perfect; no deposit was formed on any part of the preheated boiler, and the smokebox and combustion chamber remained nice and clean; firing was only needed at about five minute intervals. So all seemed clear for the further additions required to complete the job.



The L.P. motor group; frames, cylinders, pilot beam, boiler support and motion plate



Side view of chassis and first boiler

Boiler Feed Pump

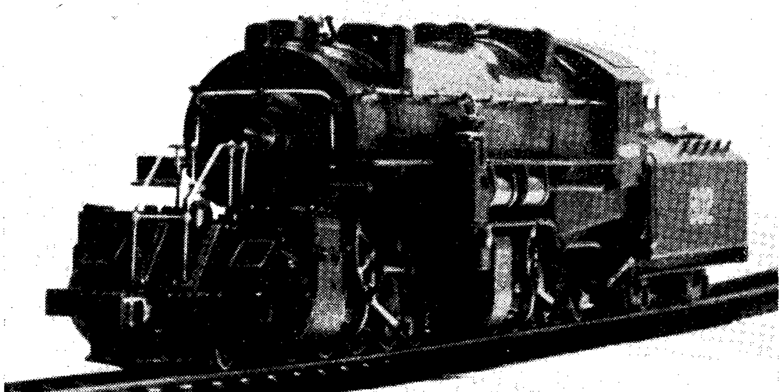
This was fitted in the space previously reserved for it. It is 5/32-in. bore and stroke, but due to restricted space, the valves are at each side of the barrel, the foot valve on the right-hand side and delivery on the left-hand side. The by-pass valve connects directly to the pump; the hexagon head visible under the l.h. side of the cab is the bypass control. Delivery is via a side clack. Since a $\frac{1}{16}$-in. ball is not heavy enough to seat itself without assistance, the clack has a screw-down valve spindle fitted for this purpose; otherwise, the contents of the boiler are liable to disappear when raising steam. Once pressure is raised, the spindle is released, and the clack operates in the normal manner. The pump is connected in series with the tender hand pump, thus eliminating one water connection.

Lubrication

The space reserved for the oil reservoir has already been mentioned. The pump is 1/32-in. bore and 1/10-in. stroke, and its crank rotates once in twenty revolutions of the driving wheels. Oil is delivered to the main steam pipe just before it enters the h.p. steam-chests. The right-hand air reservoir has been made into a displacement lubricator in view of previous experience of very small pumps. The oil reservoir is not really big enough, and if it is allowed to pump itself dry, priming against pressure is not easy; so the displacement oiler is likely to be required pretty often. The difference in performance when the oil supply fails is most pronounced.

Finishing Touches

Since this model is intended for serious work, the "frills" are only those which are essential to convey the impression of the prototype. The sand domes and bell are dummies; a working whistle is housed in the l.h. air reservoirs. Only the most prominent of such items as steps and handrails are fitted, but the couplers on the pilot beam and rear tender drag beam have pivoted knuckles and operate in the correct manner. The total working time on this model was about 2,000 hours, spread over four years.



The small locomotive on a 6 ft. radius curve, the sharpest that it will negotiate

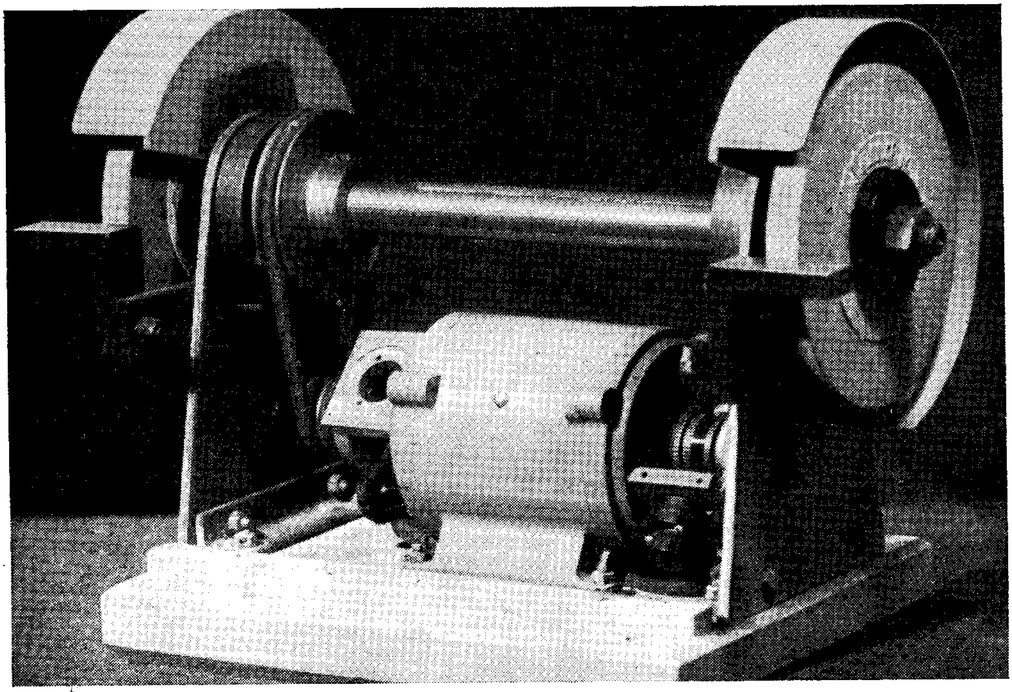
Building a 5-in. Grinder

by "Midlander"

HAVING purchased several ex-Government rotary transformers for conversion to motors, I decided to experiment with these for driving small tools, and one of my first attempts was to design a small grinder suitable for light grinding work. By light grinding I mean small drills up to $\frac{1}{2}$ in. diameter and lathe tools, etc.

My first design was only fairly successful, but from this I learned several points, which I noted, and duly altered in my second design, which is the one reproduced here. In my first design I used wheels of only 3 in. diameter and bronze bearings. This, together with the very high rev. of the spindle, soon produced a terrific noise which could only mean one thing; that the spindle bearings were becoming worn. This grinder had by now become very useful and so I decided to design a new one for 5-in. wheels and using ball-bearings in place of bronze bushes. In the first design the motor was mounted outside the grinder casing but in the second I have mounted the motor under the grinding spindle, and totally enclosed the whole.

After drawing out the general arrangement, see Fig. 1, the first parts to be cut were the main bearing plates. These were cut from $\frac{3}{16}$-in. mild-steel plate measuring 5 in. wide across the base, 7 in. high and a $3\frac{1}{2}$ in. diameter semi-circle at the top. These plates were marked out and drilled.

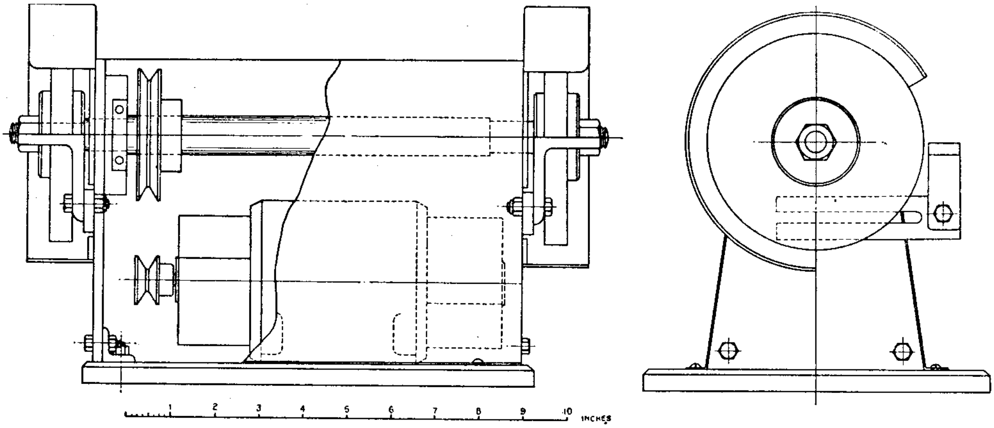


The machine minus cover, showing drive

(*a*) For the main spindle, this hole being $\frac{13}{16}$ in. diameter;
(*b*) for the bearing housings, three 17/64-in. holes for each housing;
(*c*) for the tool-rest, two No. 5 holes for $\frac{1}{4}$-in. B.S.F. tapping;
(*d*) for the angle to secure these plates to the base, these being two 7/32-in. holes;
(*e*) for the grinding wheel guards (unless the 17/64-in. bearing housing bolt holes can be used).

Two $\frac{3}{4}$-in. × $\frac{3}{4}$-in. steel angles were cut to be drilled and bolted to the bottom of the bearing plates. They were secured to both base and plates by $\frac{3}{16}$-in. Whit. or B.S.F. bolts when assembled.

The bearing housings were next turned from $2\frac{3}{4}$ in. diameter steel. These were bored to

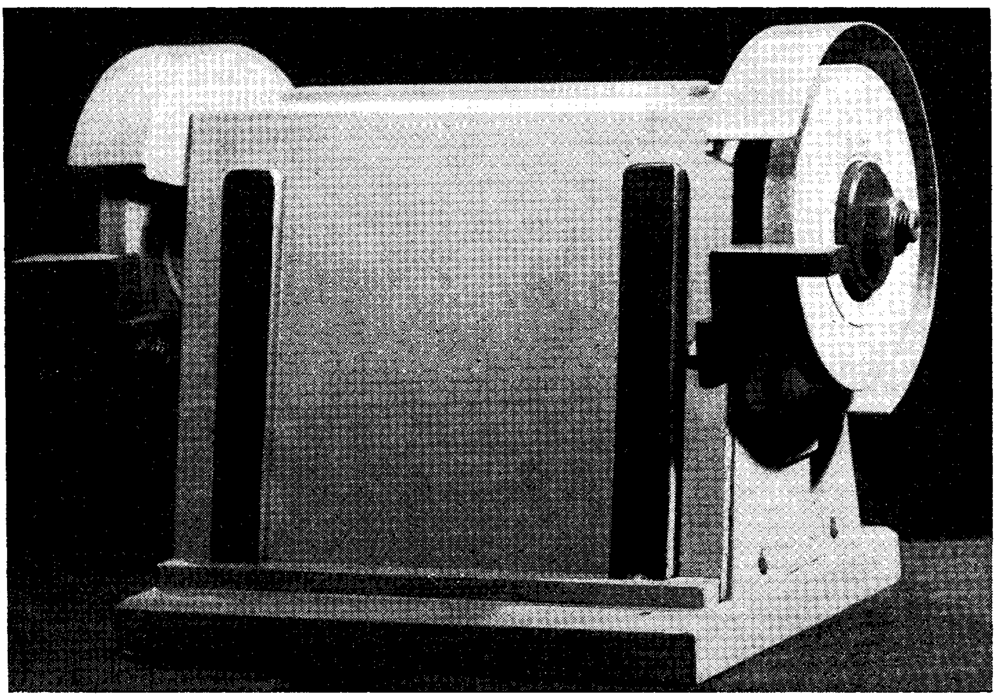


Two views, showing the general arrangement of the motorised grinder

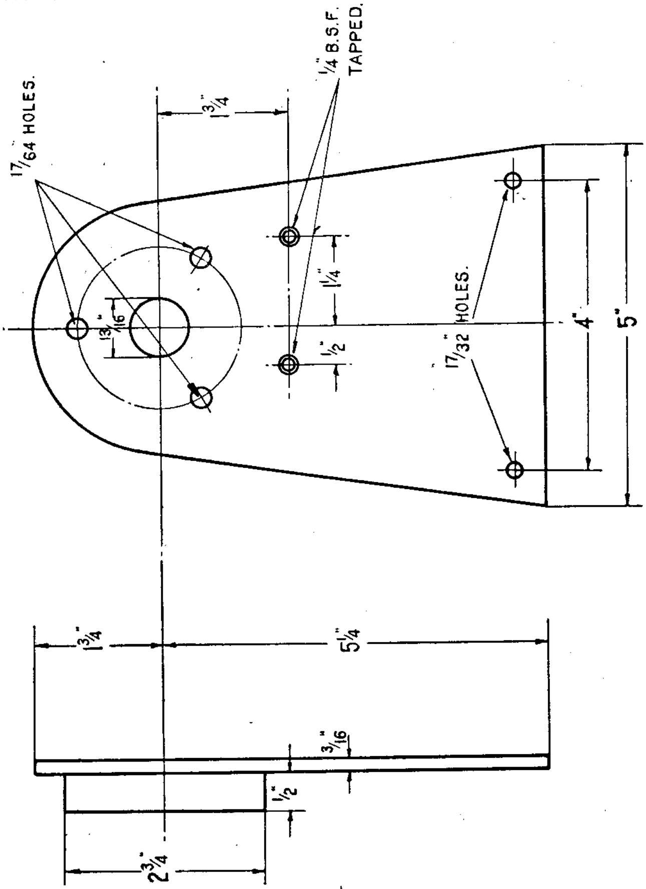
take the bearings which are type E.E.6 $\frac{3}{4}$-in. bore, $\frac{5}{16}$ in. wide, $1\frac{5}{8}$ in. outside diameter. These bearing housings were drilled to take three $\frac{3}{16}$-in. bolts to secure the housing to the bearing plates.

The base plate was cut next, from $\frac{1}{2}$-in. thick plate, and measures $10\frac{1}{4}$ in. long and 8 in. wide. This was filed and levelled, and drilled for the bolting down holes only, that is, four $\frac{5}{16}$-in. holes for bolting the completed machine to the bench. Other holes were not drilled in this baseplate until later, as I will explain.

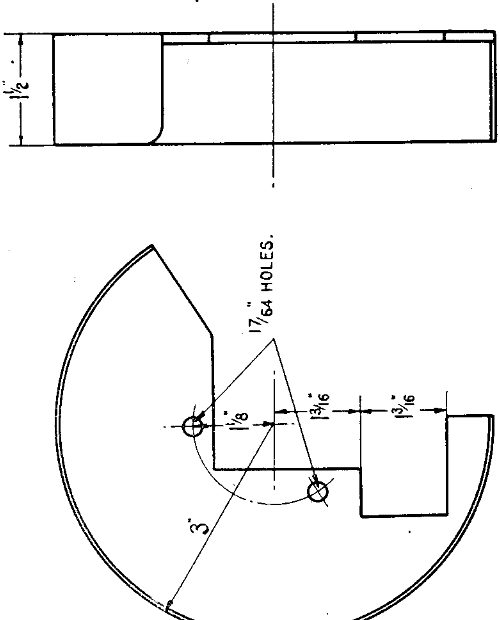
The main spindle was cut from $\frac{7}{8}$-in. bright mild-steel, and measures $13\frac{1}{2}$ in. long. This shaft was set up in the lathe to run perfectly true so the $\frac{7}{8}$-in. centre section could be left to size and the ends only turned down. This centre section measures $8\frac{1}{4}$ in. long, the remainder at the shaft ends being turned $\frac{3}{4}$ in. and $\frac{1}{2}$ in. respectively. The $\frac{3}{4}$ in. diameter fits the bore of the bearings and the $\frac{1}{2}$ in. fits the grinding wheels. The ends of the $\frac{1}{2}$ in. sections were screwed $\frac{1}{2}$-in. B.S.F. right-hand and left-hand,



The finished machine minus switch and with wooden cover



Bearing plates, 2 off, $\frac{3}{16}$-in. steel plate



Wheel guard—one left-hand, one right-hand

care being taken when assembling to fit the shaft according to the correct rotation of the grinder so that the nuts securing the grinding wheels would be tightening when at work.

The shaft was mounted in the bearings, these being attached to the bearing plates by the three bolts, and the angles at the bottom of these plates bolted to them so that the whole assembly could be set up on the base-plate and the four holes for bolting the bearing plates marked off and drilled to take $\frac{3}{16}$-in. bolts. They were countersunk on the underside so that the heads of the bolts would be flush with the bottom of the base.

The motor was also set in position at this point and the holes marked off and drilled likewise for bolting the four motor feet, by $\frac{3}{16}$-in. bolts, as before.

Pulleys were next tackled, the larger one of $\frac{7}{8}$-in. bore for the main spindle being turned from 3 in. diameter mild-steel and is grooved to take $\frac{5}{16}$-in. round belting. A boss was turned on this pulley to be drilled and tapped to take a $\frac{1}{4}$-in. Whit. Allen screw. When the exact position of this pulley was later determined, a recess was drilled in the correct position in this shaft for the Allen screw to bite into.

The motor pulley was turned from $1\frac{1}{8}$-in. diameter mild-steel and is $\frac{1}{4}$-in. bore. It is grooved, of course, to take the $\frac{5}{16}$-in. belting, and is secured to the motor shaft by means of an Allen screw which is also $\frac{1}{4}$-in. Whit.

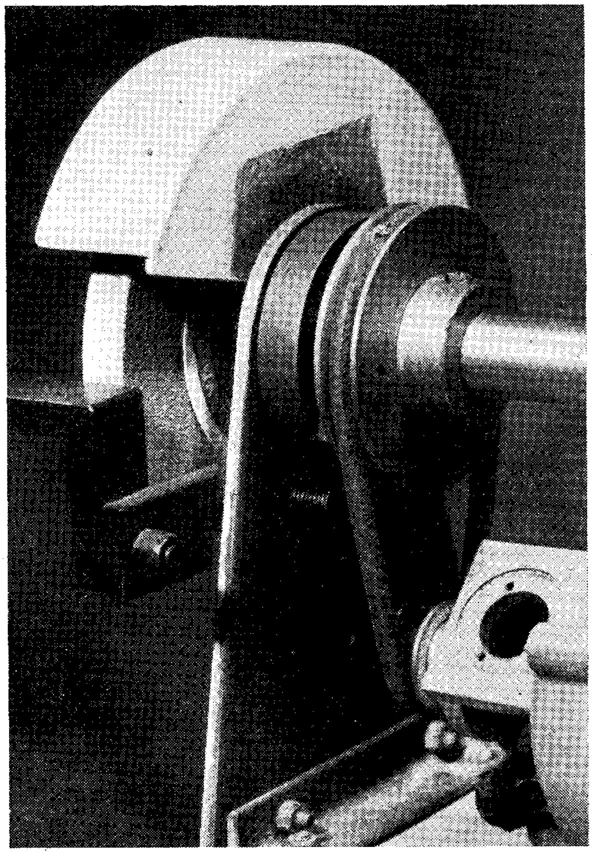
The motor, which was a type 57, was converted in the usual manner for running on 250 V a.c. mains and bolted to the base. Pulleys and belt were fitted so that the unit could be given a run to see if everything was satisfactory, and having borrowed a rev. counter from a friend, found that the spindle for the grinding wheels was running at 4,000 r.p.m.

Two 5 in. $\times$ $\frac{1}{2}$ in. thick by $\frac{1}{2}$ in. bore grinding wheels were purchased to be fitted

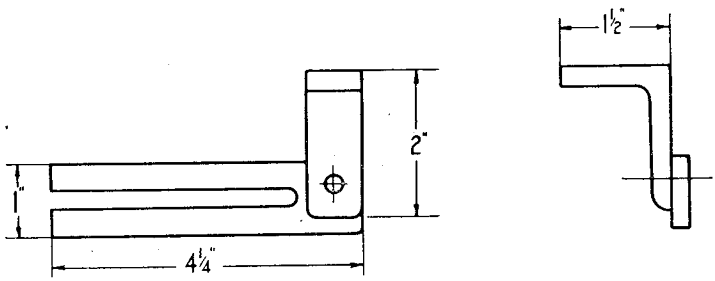
later, these being held in position by turned washers of steel ½-in. bore, 2 in. diameter and ¼ in. thick.

These steel washers were recessed as in usual practice for fitting grinding wheels, to ensure a true, firm grip on the wheels.

The tool-rests were next cut from 2 in. × 1½ in. × ¼ in. angle, these being bolted to two 1 in. × ¼ in. steel strips means of a ¼-in. B.S.F. bolt and Simmonds lock-nut, the tool-rests being able to be fixed at various angles if necessary. The 1-in. × ¼-in. strips are 4½ in. long, a slot being cut in these to take ¼-in. B.S.F. bolts, the strip sliding on these when the wheel becomes worn. The tool-rests were fitted to the bearing plates by means of the ¼-in. B.S.F. bolts, screwed into the tapped holes previously made for them.



The belt drive and tool rest



Tool-rests—one right-hand, one left-hand

A cover of $\frac{1}{16}$-in. steel plate was cut, bent and fitted over the motor pulleys and shaft, totally enclosing same. This not only for the sake of the operator's safety, but to cover the bearings and motor from the minute grinding particles from the wheels. This cover was bolted to the baseplate by four $\frac{3}{16}$-in. B.S.F. bolts in holes specially drilled for the purpose. It was made to fit snugly and tightly over the bearing plates, so that there would be no vibration when the grinder was in use.

A suitable switch was purchased and bolted to the front of this cover in the centre. Holes for this switch and wires were drilled before final assembly.

The grinder was by now rapidly nearing completion and one of the remaining sections to make were the wheel guards.

These guards were made from ⅛-in. mild-steel plate welded together, the completed guards being bolted to the bearing plates in the holes previously drilled to receive them. The guards could be made from castings or from sheet brass sweated together, if the reader has no welding facilities.

The machine was now complete save for painting, and it was partially dismantled to facilitate this. The completed machine has proved invaluable in the workshop and, considering the cost and the interesting job of building it, I think it has repaid me for the work that I have put into it.

If a reader should wish to construct a similar machine, the work could be simplified by using a hardwood base and a wooden cover if he has not the facilities for the metal work.

*Two Old-Time Models—and a Newer One

by W. J. Hughes

(Photographs by Photo Press Agency, Sheffield)

ANOTHER model built by Captain Tresidder, and in the possession of Mr. Chambers, is a $3\frac{1}{2}$-in. gauge 2-4-0 locomotive *Eve*.

I should imagine that this model preceded the agricultural engine, but cannot be sure. The locomotive was built to run, being spirit-fired, and I imagine the mechanical details would be of great interest to our friend "L.B.S.C."; though not, perhaps, entirely to his satisfaction!

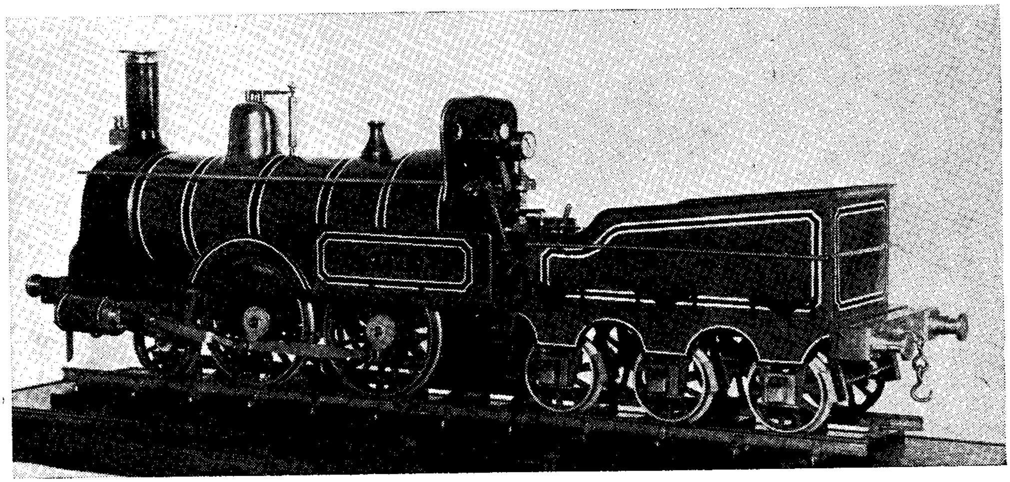


Fig. 8. The $3\frac{1}{2}$-in. gauge locomotive "Eve," another example of Captain Tresidder's craftsmanship

"The Works"

The boiler proper is fitted in an outer casing, with narrow air space round it, presumably to protect the paint, since the space has no direct connection with the "firebox." As may be seen from Fig. 10, the latter consists of an oval vertical tube into which the three burners play. From the top front of this firebox a single $1\frac{1}{4}$-in. diameter fire-tube runs through the boiler to the smokebox. The burners have asbestos wicks, and are fed from a tank below the footplate.

Steam is taken from the regulator in the dome, and thence by pipe through the smokebox to a cross-pipe underneath the locomotive which feeds both valve-chests, which are inside the frames, as the underneath view shows.

The four eccentrics of the Stephenson valve-gear are mounted in pairs inside the leading main axleboxes, driving the valve-spindles through right-angled knuckle-joints, which are visible in the photograph. The exhausts are taken direct from the backs of the valve-chests, through a tee-union to the blast-pipe in the bottom of the smokebox.

Piston-stroke is $1\frac{1}{4}$ in., with an estimated bore of $\frac{3}{4}$ in. The outer ends of the slidebars are supported by motion-brackets, which are screwed to the undersides of the running boards. To clear these brackets, the connecting-rods have long forks, which may best be seen in Fig. 10. The eyes of the connecting-rods and coupling-rods are all bronze-bushed, and are held on the crank-pins and to the crosshead by means of washers and fine taper pins.

The frames of the engine are cast in gunmetal in one piece with the buffer-beams and running-boards, on which brackets are also cast for the fastening of the superstructure. Here, as in the agricultural engine, the pattern-making and foundry-work are of a high order. Bushed axleboxes, square in shape, are slotted at the sides to slide in vertical slots in the frames with double leaf-springs over them. These springs also are slotted out at their ends, to fit over the frames, and their ends support the weight of the engine through pins driven through the frames. (See Fig. 11.)

Tender frames are similarly cast in one piece

*Continued from page 822, "M.E.," November 30, 1950.

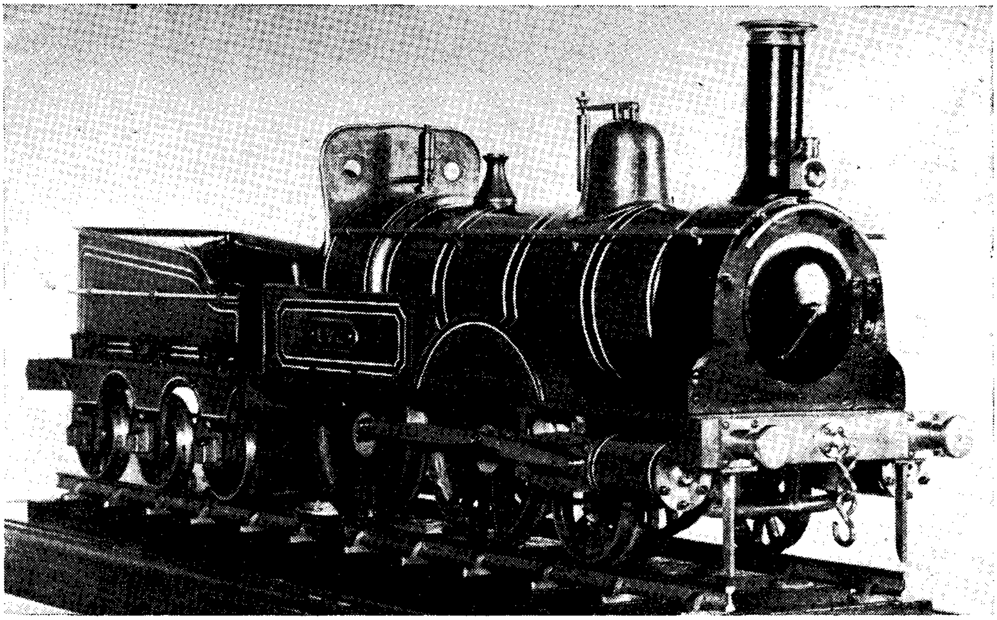


Fig. 9. Another general view of " Eve." Note forked connecting-rod, Salter-type safety-valve, and whistle

with the buffer-beams and the soleplate. Dummy springs are mounted above the soleplate, as may be seen, but the actual springing of the tender axleboxes is just as described for the engine; the leaf-springs may be seen in Fig. 8, but may not be too clear in the reproduction. The tender axleboxes have correct hinged lids, by the way. Working brake-gear is fitted to the tender, being worked by a handle at the left-hand side. Oak brake-blocks are riveted to the hangers.

Wooden buffer-beams are fitted to the cast ones, on both engine and tender, and the buffers and couplings are sprung.

Superstructure and Other Fittings

The chimney-top has a nicely flared brass rim, and the dome of polished copper bears faint but definite signs that it was " raised " by hammering up from flat sheet, silversmith manner. It conceals a more prosaic looking dome in which the regulator is housed, and on top of it a Salter-type safety-valve is mounted, as seen. A working whistle is fixed on top of the " firebox," with the operating-lever behind the spectacle-plate, which is of brass with a polished brass beading. Other backhead fittings include water-gauge, regulator-handle, and a pressure-

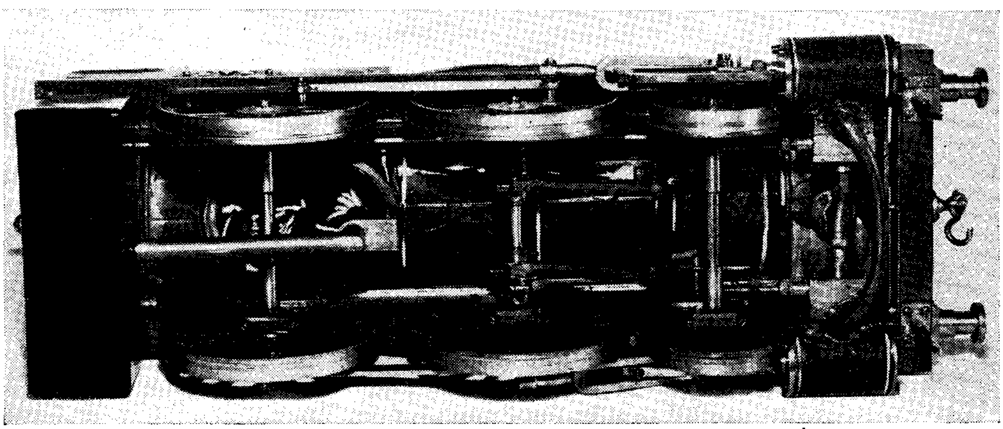


Fig. 10. Worm's-eye view of " Eve," to show firing arrangements and those of the Stephenson valve-gear. Note leaf-springs over axleboxes

gauge which appears to be "home-made." The graduations are certainly marked out by hand, and read up to a maximum of 10 lb. per sq. in., so that working pressure was evidently not very high!

On the footplate, which is chequered by filing, stands the quadrant which holds the reversing-lever for the Stephenson valve-gear. The quadrant has several notches, and a small latch is fitted to the lever.

Fig. 11. Diagram to show how spring is slotted at ends to fit over frames. The weight of the locomotive is carried on the transverse pins resting on the ends of the springs

The engine and tender are painted green, with black and white lining. Notice the nicely executed flared coping to the brass tender sides, by the way, and the way it is carried round the front and back corners. More silver-smithing! The nameplates have letters cut from copper sheet soldered to brass backplates, with black background and a polished brass beading round the outside. Handrail knobs are filed to shape, not turned, and they and the rails appear to be nickel-silver.

The wheels are brass (or, perhaps, gun-metal) castings, painted green with red balance weights and red centres.

Over the buffers of the engine and tender, the length is $25\frac{3}{4}$ in., and the height to the top of the chimney is 9 in.

I make no apology for describing the agricultural engine and the locomotive in such detail, for examples of the model engineering of half a century or more ago are very scarce. Apart from that, however, the ideas of the period were so different that it is interesting to look back over time and see how the craftsmen of the day actually did their jobs, without half the advantages that we moderns have. These two examples will serve to show that the model engineer of that period could hold his own with anyone, and it is interesting to speculate what Captain Tresidder would have made of a *Hielan' Lassie* or other small locomotive. It is highly probable that had he been told, when building *Eve*, that half a century later there would be thousands of smaller locomotives capable of hauling live passengers, he would have been very doubting. For at that very period, young Curly's work was still in the experimental stage, and the initials "L.B.S.C." were merely those of a certain railway company!

An "Exploding Battleship"

The next model was built by Mr. Chambers himself, and though it cannot be described as a *scale* model by any stretch of imagination, the engineering principles of the mechanism are sound and well carried out in good craftsman style.

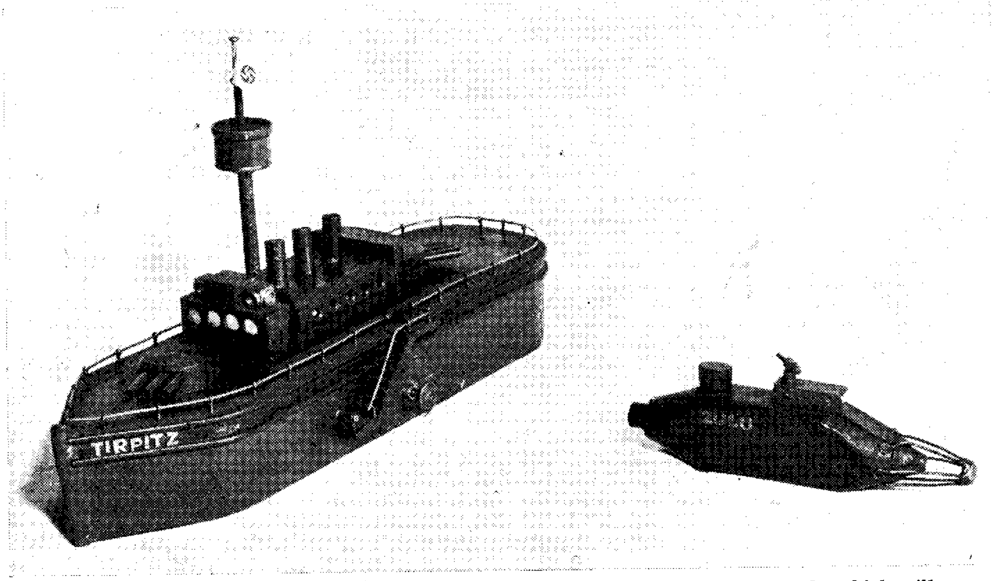


Fig. 12. "Let t' battle commence!" "Zulu" prepares to launch the torpedo which will—

Readers will remember that some years ago, during the war, an article appeared in THE MODEL ENGINEER, dated May 20th, 1943, entitled, "Torpedo the *Bismark*," in which a toy submarine was used to fire a torpedo at a target fixed on the side of a model battleship. When the target was hit, the battleship "exploded," owing to the release of the energy contained in a breakback type of mousetrap, and to the fact that the superstructure of the ship was built up in small sections.

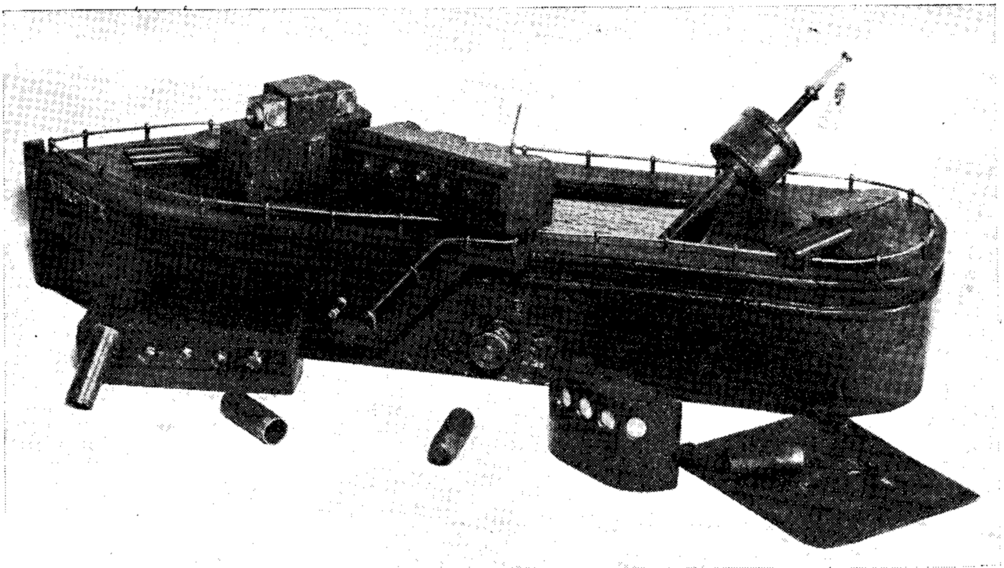


Fig. 13. —*blow " Tirpitz " to pieces! In actual practice, of course, the range would be greater than that shown in the last photograph. The " Tirpitz " is* 18 *in. long, and the " Zulu "* 7¼ *in. overall*

When I first heard that Mr. Chambers had a similar sort of model, I assumed that he had based it on that described in THE MODEL ENGINEER, but this assumption turned out to be wrong, for he is not a reader of our journal. Apart from that, however, although the first principle is the same, in that a spring is used to " explode " the battleship, the mechanism is quite different in design and arrangement, and was entirely thought out and developed by Mr. Chambers.

Briefly, the steel " torpedo " is placed in the torpedo tube at the bow of the submarine, and is pushed down by means of a rod, which has a cap for hand-comfort, against the pressure of the firing-spring. When fully home, it is held in place by a trigger actuated by the submarine's " gun."

The spring which disintegrates the ship is " loaded " at the same time, being held by a trigger connected to the target-button on the port side. The various parts of the superstructure are then fitted loosely in position. (Fig. 12.)

Properly to test one's markmanship, the submarine is withdrawn about 18 in. from the ship, and then, on striking the *Zulu's* gun, the torpedo speeds to its target and the *Tirpitz* blows up with highly satisfying results—if one's aim was true!

The mechanism in both submarine and battleship is quite simple, and I have no hesitation in saying to any toy-manufacturer that here is an idea well worth following up—probably most of the parts could be moulded in plastic. I am sure the designer would be pleased to discuss the matter with anyone interested.

Mr. Chambers' *Tirpitz* has done good

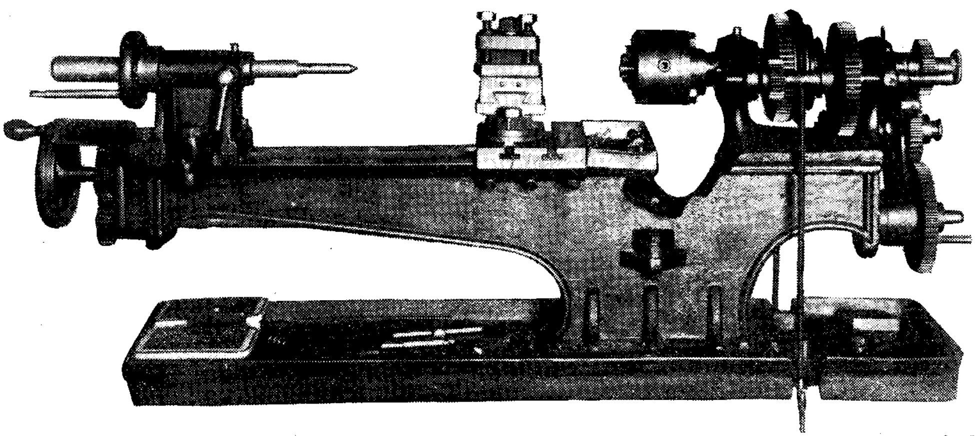


Fig. 14. *The old* 3½-*in. Drummond lathe which is described in the text. How many more of this vintage are left, we wonder?*

work in earning money for worthy causes, and in addition, has given pleasure to many visitors—not only children, be it noted!

An Old Drummond Lathe

My last photograph shows the $3\frac{1}{2}$-in. centre lathe used by Mr. Chambers. This is over 40 years old, and belonged originally to Capt. Tresidder. (Much of the latter's work on the agricultural and railway engine models was done, however, on a rather larger lathe.)

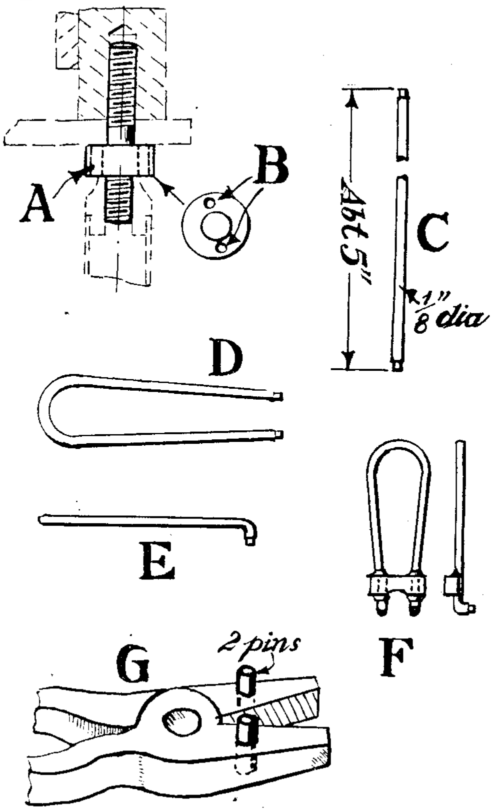
It is an early type of Drummond lathe, with the leadscrew running through the centre of the box-casting of the bed, that is, between the vertical webs. For taper-turning, the *headstock* may be swivelled, and the tailstock suitably adjusted. All the handwheels are graduated in thousandths, and there are many extra change wheels cut in boxwood. A very complete table of change-wheel combinations, occupying several sheets of foolscap, gives all particulars of a range of screw-threads, in both British and metric threads, from $2\frac{5}{8}$ t.p.i. to 81 t.p.i. There is also a complete range of male and female screw chucks, from $\frac{1}{16}$ Whitworth upwards, with many B.S.F., B.A., and metric sizes, and quite a number for left-hand threads. These are housed in beautifully fitted boxes, with every size neatly labelled.

All the above-listed fittings were made by Captain Tresidder, who also did the hand-wheel graduation, but Mr. Chambers has made a large number of accessories in addition. These, too, are racked in cupboards, and include milling attachments, dividing gear, fixed and moving steadies, knurling tools—in fact, space would not permit a complete list of all the fitments!

The lathe is well looked after and is in excellent mechanical condition. It is still treadled by Mr. Chambers, in spite of the fact that he is well into his seventies. As I remarked earlier, he is not a model engineer, but uses the lathe and workshop for household jobs for himself and for friends, or on little jobs for the car. At the same time, he is keenly interested in all engineering models, and the agricultural engine in particular is his pride and joy.

But so it could be to anyone, I think, with its unusual and interesting design, and above all its beautiful workmanship and finish!

A Spanner for Circular Nuts



THE writer, in taking off the stage of a microscope, in order to prepare it for the reception of an attachment, found the part to be attached to the body of the instrument by a stud, shown at *A*. This had a circular part with two holes in it, *B*, for which the makers of the instrument have some special key to assemble the parts by turning the stud.

The problem of unscrewing this was solved thus, in a few minutes.

A piece of $\frac{1}{8}$ in. dia. mild-steel was turned down at the ends to fit the holes in the stud, as at *C*. This was then bent into a "U" shape, shown at *D*. Then the ends were turned over in a vice, forming the shape *E*.

The ends of the shaped piece of rod entered the holes in the nut, the "spring" in the metal keeping the tool in position, while the "U" part was turned carefully, the stud turned with it and was at once removed. If the tool was needed for use on strongly made and larger articles where such circular nuts occur, there could be added a bridge-piece, brazed or welded on, as at *F*, but in that case it would only enter the holes in one particular size of nut.

Another way of shifting these circular nuts, when the special keys and spanners which come with tool kits may not be available, would be to braze two pins into the jaws of an old pair of pliers, shown at *G*. Of course, the jaws of the pliers would be softened by doing this, so only an old pair which have been discarded for other work should be used.

—H. H. NICHOLLS.

Repairing a Washing Machine

by "Base Circle"

IT is often suggested in the pages of this journal that the wives of model engineers do not always appreciate as much as they might the activities of their husbands. At the best they seem inclined to look upon their activities as a form of more of less harmless childishness which may have to be tolerated but should certainly not be encouraged. To counter this attitude it seems to be considered good policy, every now and then, to make some attempt to propitiate the lady of the house by producing some article which the poor misguided husband fondly obtained. This was soon found to be impossible, as the machine is a fairly old one, of American origin, and spares for such a machine are not now stocked in this country.

All in all it seemed that, if a repair could be effected, this would provide for the powers that be, an excellent demonstration of the fact that a home workshop isn't always a liability.

Great care was taken to make the most of the situation by first getting quotations from one or two small local engineering firms for the manufacture of a replace part. As expected, the prices

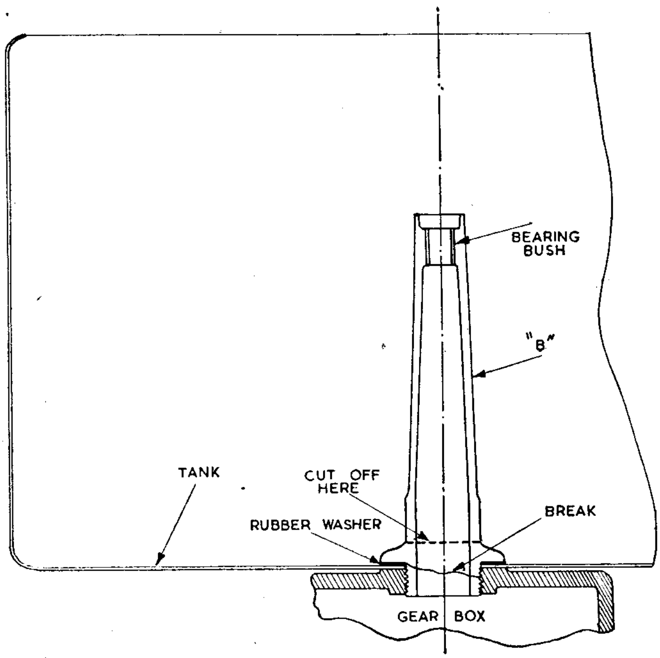


Fig. 1

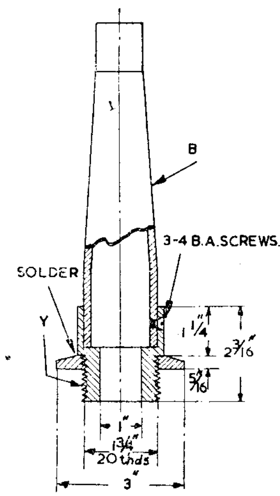


Fig. 2

imagines will be received with rapture and will earn her undying gratitude.

It has not been my experience that such efforts are ever very successful. Women in general seem to be rather conservative and are not too ready to appreciate the clever gadget which has cost so much labour in the making—unless, of course, Mrs. So-and-So next door already has such a gadget ! ! !

The writer does not profess to be a model engineer in the true sense of the word, but he possesses a fairly well equipped workshop in which there always appears to be some job or other to do.

Recently the family washing machine broke down and on examination the damage seemed beyond repair, unless a spare part could be quoted were quite prohibitive—in one case about half the original price of the machine.

The nature of the damage will be seen in Fig. 1. The casting *B* which supports the agitator shaft is screwed into the cast-iron gearbox housing, while between the flange of *B* and the facing is sandwiched the tank, the joint being made watertight by a rubber washer.

The casting *B* is die-cast in a zinc-alloy and either through old age or because of a flaw in the metal it had broken off at the neck of the screw as shown.

Well, the machine was dismantled and the broken part of the screw was got out by slitting in several places with a hacksaw blade. This caused a difficulty right away, as the diameter of

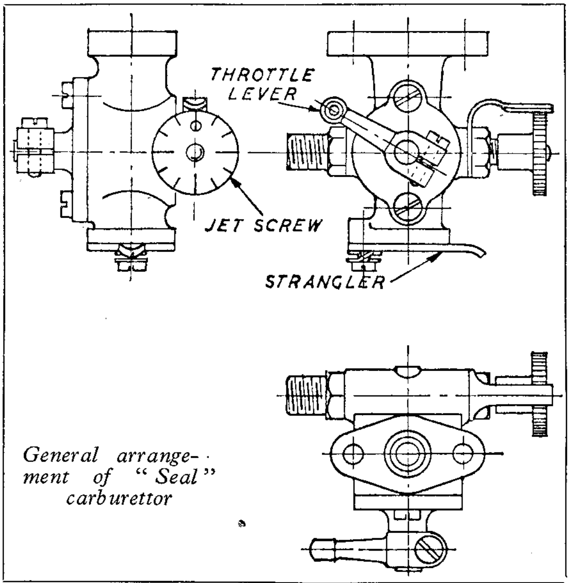
(*Continued on page* 889)

PETROL ENGINE TOPICS

*A 10 c.c. Twin Four-Stroke

by Edgar T. Westbury

THE carburettor recommended for this engine is that designed for the " Seal " engine, which although a simple and straightforward type, nevertheless, has a good range of control, and in that respect is much superior for this particular purpose to the majority of carburettors at present used on miniature engines. It also harmonises with the general design of the engine, and being of the vertical up-draught type, can be compactly arranged under the manifold so that it does not project unduly outside the space occupied by the engine itself. Other types of carburettors, however, can be used if they are preferred by the constructor, and carburation problems are not increased or complicated by adding to the number of cylinders on an engine, but rather the reverse, so that any carburettor which works well on a single-cylinder engine may be expected to behave just as well on a twin. Distribution of the mixture to the individual cylinders, however, is another matter, and may be troublesome unless great care is taken with the manifold system ; this matter has already been dealt with in the previous article in this series.



General arrangement of " Seal " carburettor

For the guidance of readers who may not have access to the articles dealing with the " Seal " engine, which were published during the first half of 1947, the drawings of the carburettor are published herewith, but in view of the straightforward nature of its construction, I do not consider it necessary to describe this again in detail. It may, however, be helpful to make some comments on the principles on which the carburettor works, because although I have on several occasions dealt with the basic theories of carburation, there are still many petrol engine constructors who persist in perpetrating ancient errors in carburettor design or adjustment, and the subject is still, quite unnecessarily, " wrapped in mystery."

The simple spray carburettor, consisting of a fuel metering jet in a constricted air tube, is the basis of all modern carburettors, and such elaborations as are added to it are for the purpose of improving the ability of the device to work under variable conditions of load and speed. To regulate the speed of an engine, the most satisfactory method is to control the quantity of mixture admitted to it, which can be done very easily by means of a control valve or " throttle " ; but the addition of this fitting to a primitive type of carburettor is not always the simple matter it might appear to be. The output of the fuel jet is influenced by several factors, including the suction, or difference of pressure caused by the flow of air through the " choke " tube, and its velocity, and in practice results in changes of mixture strength unless special measures are taken, in the design of the air passage, the fuel jet, or methods of feeding it with fuel. In different types of carburettors, the means of compensation vary widely, and are in some cases very complicated, but the simplest, or at least easiest understood, method which gives reasonably good results is that in which the throttle valve is so designed that it tends to modulate the suction and air velocity in the region of the jet according to the degree of valve opening. This is known as " mechanical compensation " and is very popular in motor cycle carburettors, though the action of the throttle is often supplemented by direct metering control of the jet or diffuser by means of a tapered needle.

A feature which is common to practically all full-sized carburettors is the provision of some device for ensuring that the pressure or " head "

*Continued from page 796, " M.E.," November 23, 1950.

on the fuel fed to the jet is kept constant, as alterations in this respect would also influence the strength of the mixture. The usual device for this purpose is the float feed, which works in precisely the same manner as that fitted to the domestic water cistern, and calls for no detailed explanation. In small engines, where the fuel tank is shallow, and no considerable variation of the head of fuel is ever encountered, the need for float feed becomes much less urgent, and it can be dispensed with at very little detriment to carburation efficiency. Few constructors of model petrol engines at the present day could be induced to fit float chambers to the carburettors owing to the extra complication they entail, and their liability to erratic action under the effects of engine vibration.

In the "Seal" carburettor, the principles of compensation employed are similar to those which have been applied in several full-sized carburettors in the past, not to mention several of my design which have been used successfully on model engines, namely, the use of a barrel throttle which can be arranged to provide differential control at its intake and discharge edges, the latter being used as the "quantity" control and the former the "quality" control. In this particular type, the jet is situated between these points, and is in addition, provided with a very small primary air passage or "air bleed" which also affects compensation to some extent.

When the throttle is wide open, the carburettor acts in much the same way as the plain mixing tube type, and the mixture strength is regulated by the jet needle in the usual way. But on partial closure of the throttle, the air velocity at the point where the jet discharges into the main air passage will depend on the respective sizes of the openings at the intake and discharge sides of the throttle barrel. It is clear, therefore, that if these are individually varied, by reaming or filing one or other of the openings, the tendency for the mixture to become either richer or weaker as the throttle is closed down, can be corrected.

This principle was fully described in dealing with the "Seal" carburettor, but I have found that many constructors of this engine have not been able to obtain the degree of control which should be possible, and I would like to emphasise that it is no use whatsoever constructing such a carburettor unless one is prepared to go to a little trouble in getting it to function correctly. It may be that the inexperienced constructor is afraid of spoiling the carburettor by tinkering with the air passages; but experimental work of any kind is bound to involve some risk of this nature, and one is not likely to do much harm if the alterations are made gradually and with due discretion.

I assure readers that tuners of motor cycle engines in the past had to do a lot of work on the cutaway of throttle plungers and similar parts, though I believe that the carburettor makers know most of the answers now; I remember spending hours in filing "odd thous." off carburettor needles to get just the delicate precision of acceleration needed to get away ahead of the other fellow. In this case we are not concerned with the split-hair precision required for racing and the problems are not so critical. Remember that if the mixture weakens as the throttle is reduced, the discharge side should be opened up; if it is enriched under the same conditions, the intake side should be opened. I have suggested the use of a taper reamer for the tuning process, because it is the simplest; but local cutting away of the throttle barrel at the opening edges will produce the same result. The size of the air bleed hole through the jet tube will also affect mixture control—opening it up will weaken the mixture at low speed—but I am averse to doing this because it may raise the lower limit of idling speed, or "tick-over."

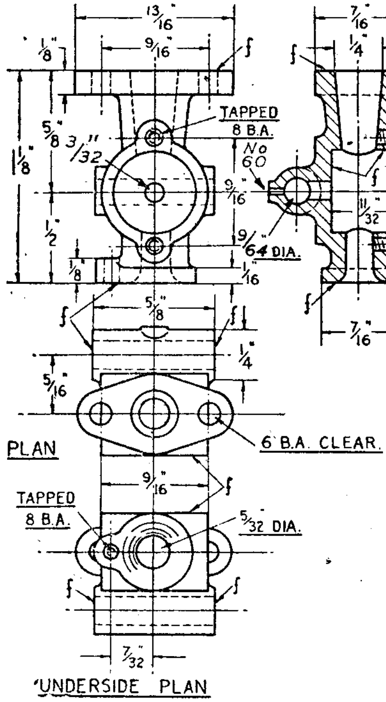
I would like to emphasise that there is a unique charm about a really docile and flexible engine, which must be experienced to be believed; and it is worth while to take any amount of pains to achieve this. Many experienced model petrol engine enthusiasts have expressed wonder and admiration at the way the "Seal" engine will tick over almost inaudibly, yet "jump to it" at a touch on the throttle lever. But some constructors are not yet convinced that these results are possible, and, therefore, will not take pains to achieve them.

Water Service Pipes

The water circulation to the jackets of the "Seagull" engine is arranged by the fitting of branched copper service pipes, the individual cylinders being fed "in parallel," by feeding the water to the lower connection to the barrel and discharging it at the head. It is not considered necessary to show detail drawings of these pipes, as they are quite simple and obvious, and the flanges are the same dimensions as those with which they make contact, on the barrel and head castings respectively. The inlet pipe branch should have a wide enough sweep to run well clear of the breather pipe, but the discharge pipe may have much tighter bends to avoid taking up too much headroom, especially if the engine is to be fitted below decks.

No methods of pumping the circulating water are shown, but in most boats to which the engine is likely to be fitted, a simple scoop would be sufficient to feed the small amount of water required for adequate cooling. If, however, a circulating pump is considered necessary, the one designed as an auxiliary feature on the "Seal" engine, and described in the issue of THE MODEL ENGINEER, dated July 24th, 1947, would be quite appropriate and efficient. The use of a separate pump, driven by gearing, direct coupling or belt from the engine or transmission shaft, though less compact and workmanlike than one built in to the engine, is quite in keeping with full-size practice, and reasonably satisfactory.

I regard the centrifugal type of pump as the most suitable for this purpose, as it is not only mechanically simple, but less likely to be impaired by wear or fouling than either reciprocating or gearwheel pumps. The water intake to the boat should be fitted with a coarse filter screen, as although a centrifugal pump will deal with a certain amount of solid matter in the water, it can scarcely be expected to cope with leaves, gravel or driftwood.



Carburettor body

cylinder-heads, a very common practice in marine engines, which is both neat and serviceable. In the absence of such provision, it is difficult to keep the leads from dangling on hot pipes, or to protect them from oil or water. Here again, neatness is a definite asset, and the reliability of the ignition system is enhanced by fitting terminal tags to all leads, and sleeving the ends with sistoflex or p.v.c. tubes to prevent kinks and fraying.

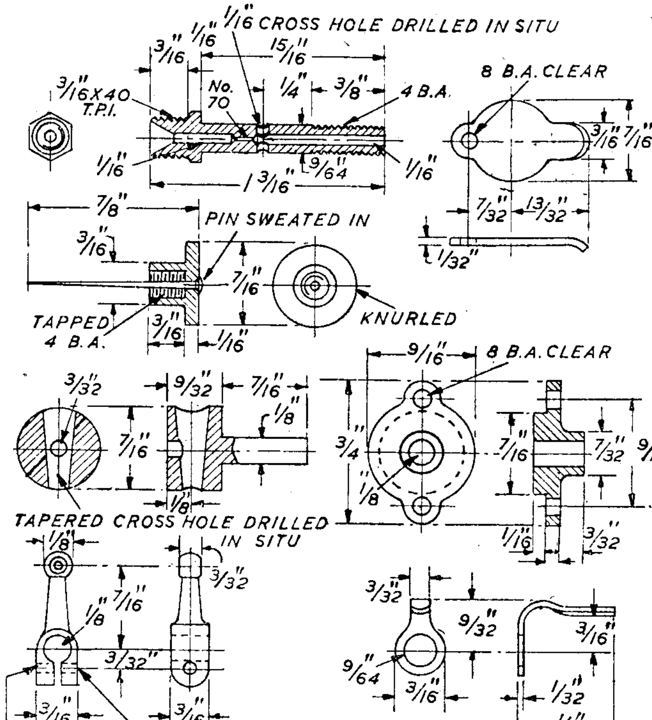
Final Assembly

If the engine components have been machined and fitted as recommended, the assembly should be quite straightforward, and little comment on it is necessary. The use of jointing material on joint faces is not recommended, though thin paper gaskets are permissible in all cases except the horizontal joint of the crankcase. Liquid jointing preparations, or even shellac varnish, should be quite sufficient to ensure air- or oil-tightness of accurately machined and lapped joints.

In the detail drawings of the timing gears, internal keyways were shown in both the timing and idler pinions ; in the latter case, this was an obvious mistake, as the very fact that it is an idler precludes the idea of keying it to a shaft. Even the pinion which is fixed to the crankshaft need not necessarily have a keyway of the orthodox kind. It is not, in actual practice, easy to locate the relative positions of the keyways in the shaft and pinion, as this is complicated by the particular

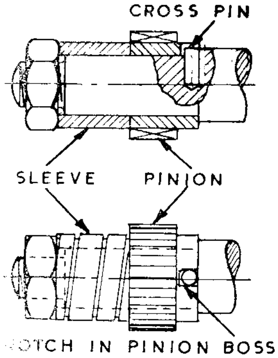
One thing I would beg of readers in installing the engine, either in a boat, or for any other purpose ; take a little trouble to arrange pipework and other accessory fittings as neatly as possible. So many engine installations look more like a riot in a junk yard than a respectable engine room. Nearly everybody nowadays seems to favour the use of flexible tubing, mainly because it is much easier to slip it on to the connection than it is to fit a neat flange or union on a copper pipe, or to make a workmanlike bend or brazed joint. The excuse is often made that flexible tubes stand up much better to vibration ; but vibration is a sympton of mechanical faults and inefficiency—why tolerate it ? I am convinced that unsuspected leakages in slip-on flexible connections are often the source of mysterious troubles in fuel feed and other pipe-lines.

It will be noted from the photographs of the engine that the ignition leads are carried in a fibre tube clipped to the



Group of carburettor components

arrangement of the offset idler pinion, and even more so if the gears are different in any respect those specified.



Alternative method of keying timing pinion

Timing up the engine is, in my experience, best carried out by trial, using a protractor or marking the flywheel to correspond with the timing diagram. The timing pinion, if made a good fit on the shaft and clamped endwise by the sleeve and nut, will not take much driving, and the alternative to a full keyway shown here will be found quite satisfactory. It will be seen that a notch is cut in the boss of the pinion, and after the engine has been properly timed, a hole is drilled through this notch and into the shaft, into which a $\frac{1}{16}$-in. steel pin is driven. This can be done while the engine is assembled, except for the timing case. A No. 53 drill should be used to drill the hole, and the pin must be a really good fit, not tapered on the end and driven in by brute force. It must then be filed flush with the enlarged part of the shaft, or subsequent removal of the shaft through the main bearing will not be possible.

Several readers have taken up my suggestion that the design of this engine is adaptable to varying numbers of cylinders, and have asked for drawings of the necessary modifications. For the present, I am proposing only to show the conversion of the crankcase for a single-cylinder version of the design ; adaptation of other parts should be fairly obvious. I have also been asked to describe an air-cooled engine on the same lines as the " Seagull," and I will do my best to give some information on this point also.

(*To be continued*)

Repairing a Washing Machine

(*Continued from page* 885)

the screw could not then be accurately measured. The number of threads per inch, however, was 20, and the diameter approximately $1\frac{3}{4}$ in.

The lathe available—an old Drummond $3\frac{1}{2}$-in. did not permit a completely new part to be made so it was decided to fit a new end piece to the broken casting as shown in Fig. 2. The broken casting suitably trimmed off (at dotted line) was to be a drive fit in the new part. Fortunately the existing casting had been turned to a good finish at this part, possibly to suit a steady rest when being made.

Well the first thing to do was to make sure of the screw ; so a gauge plug was turned and screwed twenty threads per inch. It was made slightly over $1\frac{3}{4}$ in. diameter and gradually reduced until it was a sufficiently good fit in the gearbox. When trying in place, the plug was not removed from the chuck as it would have been difficult to re-chuck it truly. Instead, the chuck, complete with the plug, was unscrewed from the mandrel nose.

A search for a suitable piece of material produced a chunk of gunmetal about 2 in. diameter, and of suitable length. This diameter did not, of course, allow of the flange being turned from the solid, but this was not altogether a disadvantage, as by turning the flange separately from a convenient disc of brass and screwing it to fit the test plug, it formed a most convenient gauge for the screwing of the part *Y*.

The first operation on *Y* was to turn down to $1\frac{3}{4}$ in. diameter and bore an opening hole 1 in. diameter right through. It was then screwed a good fit in the flange.

It was next removed from the lathe, screwed tightly into the flange and well sweated with soft solder.

The other end was then turned and bored with the assembly chucked by the outside of the flange. The bore was carefully machined to give an interference fit of 0.003 in. on the broken casting.

The job was removed from the machine and the casting pressed well home. Fortunately, it proved to be a very good fit. Three 4-B.A. countersunk head screws through the gunmetal into the die-casting gave additional security though they were probably unnecessary.

The rebuilt part was then cleaned up and the opportunity was taken to clean and oil the machine thoroughly—an operation, which, I fear, has been sadly neglected in the past.

On reassembly, the machine appeared to be as good as new, and peace reigned once more in the household.

Tightening Ferrules on Tool Handles

by W. M. Halliday

THE thin pressed steel ferrules usually provided on the shanks of wooden handles used on chisels, files, and similar hand cutting-tools, possess a very annoying and sometimes hazardous tendency to work loose after some use.

If the ferrule should come completely adrift, the tang of the tool may be loosened to a dangerous degree. Should this occur in respect, say, of a wood chisel, the whole handle may easily be split as a result of being tapped with the mallet. The danger of a severe hand injury makes it extremely unwise to continue using a tool with such a damaged handle.

In the case of hand files used for metals, hand injuries are very often caused by reason of the excessive loosening of the wooden handle due to a slack ferrule. The normal action of filing will also cause the handle to leave the tang very frequently, and much time will be lost in fastening the part in position.

removed before applying the ferrule to the shank of the handle.

To mount the ferrule in place, the two prong pieces *C*, should be forced slightly apart so as to clear the shank of the handle.

The extreme tips of the prongs should be turned inwards, approximately at 90 degrees, so that they will bite into the wood.

After the ferrule has been placed on the shank of the handle, all that remains is to force the prongs *C* down. This may best be done by placing the ferrule in the vee-block and using a small punch to drive in the two prongs, thereby preventing the ferrule from moving radially or longitudinally on the shank. It should also be noted that this method does not incur the raising of any projections or sharp edges on the ferrule which would be liable to cut into the fingers of the operator.

The second method shown at Fig. 2, is even

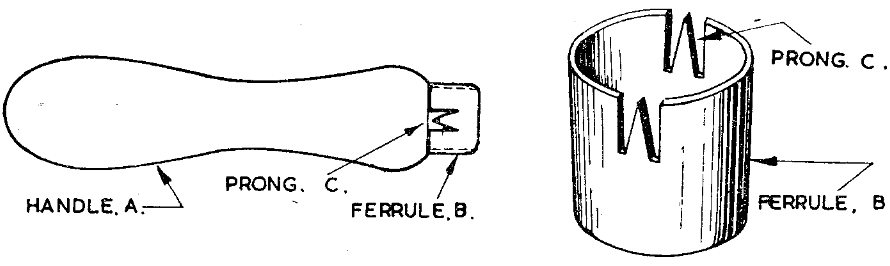


Fig. 1

Three very simple, yet most effective, methods for tightening and permanently locking a loose ferrule to its handle are here described and illustrated. Each of these methods entails only the simplest alterations to the shape of the conventional type of ferrule and handle, and each is equally applicable for use with either wood chisels or files.

The first method illustrated at Fig. 1 comprises the provision of two or more small gripping prongs formed on the open end of the ferrule in the manner shown.

At Fig. 1, *A* is the wooden handle, *B* is the steel ferrule, and *C* is one of the prongs mentioned.

The view at the right shows an enlargement of the modified ferrule. Two prongs are provided, these being located diametrically opposite to each other, at the open end of the ferrule.

To form such prongs, all that is necessary is to make two narrow saw cuts, about $\frac{1}{4}$ in. deep. These cuts should be situated approximately $\frac{3}{8}$ in. apart. The portion of metal remaining between the slits should then be filed equally at each side to bring the part to a sharp point in the manner depicted. The ragged edges of the prong and the slits should be carefully

simpler than the above. It consists merely in first mounting the loose ferrule in position on the handle, then holding the latter horizontally by resting it in a vee-block, or upon a flat metal surface. With a finely pointed prick punch, the side of the ferrule is then indented at a number of equally spaced points around its circumference.

This is clearly depicted in the sketch. *A* is the handle, *B* the ferrule and the punched impressions are shown at *C*.

Three or four such pierced indentations will usually suffice to retain the ferrule smartly and permanently in place.

When indenting the ferrule in this manner, care should be taken to pierce clean through the wall thereof, so that a ragged edge will be raised on the interior of the part. This will, of course, be pressed down into the wooden shank of the handle, and thus serve to hold the ferrule still more securely.

The third fastening method is illustrated at Fig. 3. Whilst this is equally as effective as the two previous examples, it does require rather more preparation, and a simple alteration of the wooden handle.

The first step is to cut a narrow groove *C*

around the shank *B* of the handle *A*. This groove should be located at the end of the shank where it joins the shaped portion of the handle, as shown. The depth of this groove should preferably be not greater than about 3/32 in. As will be seen, the base of the groove is tapered off at about 30 degrees.

The view at the right, showing an enlargement of the ferrule *D*, indicates the manner in which this member has to be adapted.

The open-end portion is provided with a number of ears of the kind shown at *F*. These are equally spaced around the periphery of the part. The ears are formed simply by making a series of equally spaced saw cuts, *E*, into the wall of the ferrule. These cuts should extend for about $\frac{3}{16}$ in. depth, and should be not more than about 1/32 in. wide.

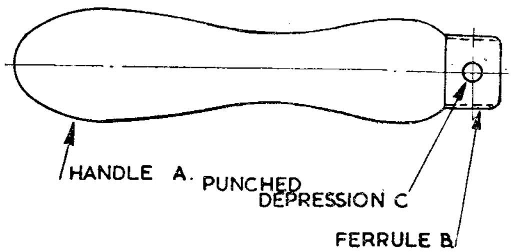


Fig. 2

After slotting the ferrule in this manner, all the rough edges should be removed from the sides of the ears. The ferrule may next be placed on the handle, and mounted in a horizontal position, preferably in a vee block, the ears *F* should be punched down into the groove C. When all the ears have thus been formed into the groove, it will be found that the ferrule is very tightly fixed in position and cannot turn or move off the shank.

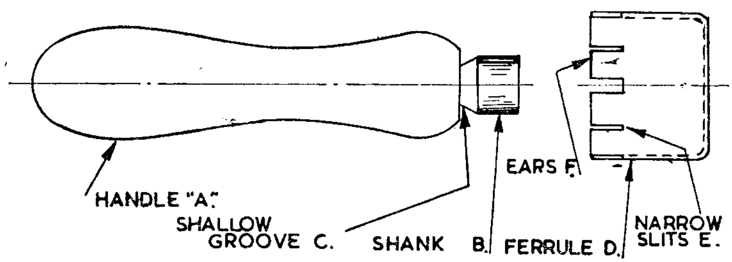


Fig. 3

Making and Fitting a New Ferrule

Incidentally, a new ferrule can easily and quickly be made up for any wooden handle from a piece of discarded pipe coupling, such as an old tee piece, or union, which, of course, will have internal threads.

A short length should be sawn off such a tee piece, and filed to remove ragged edges and sharp corners. The ferrule should then be screwed on to the wooden shank of the handle, making its own thread. This will give a very secure retention to the ferrule, and, moreover, it will be much stronger than the usual very thin-wall pressed steel ferrules ordinarily employed.

If any difficulty is experienced in threading on the piece of pipe, the threads of that component may easily be made to cut in an effective manner simply by filing one or two slots into the wall of the tube. These slots should extend slightly below the root of the threads, and, of course, a very sharp corner must be retained at their crests.

Preventing a Handle Splitting

The writer has very often successfully overcome the splitting of wooden handles on chisels arising from contact with the mallet.

The head of the handle should be turned down to provide a short parallel portion and a square shoulder. A short length of internally threaded steel pipe, taken from an old tee joint, is then simply screwed on to this shank, in exactly the same manner as with the preceding example shown at Fig. 3.

This steel pipe should be made slightly longer than the shank portion turned on the handle, so that the metal will project about 1/32 in. beyond the endface of the handle.

This steel piece screwed on to the end of the handle will, of course, withstand much more severe hammering without incurring the risk of splitting the handle. It is a very simple and useful modification, well worth while making for those tools having to perform heavy chiselling work with the mallet.

Fitting Tool Tangs to the Handle

With a new handle, the tang portion of the tool should always be carefully fitted into place, so that the stop collar at the base of the tang will bear up against the endface of the ferrule. This is necessary to prevent the tool from being forced deeper into the handle during use.

Such a fitting is best performed by heating the tang portion and burning it gently into the wood. By this means a socket of exactly the same taper and shape as the tang will be formed, without risk of splitting the handle, and a more permanent retention of the tool will be obtained.

The tang should be burned in until the collar at the base of the tang is about $\frac{1}{8}$ in. away from the end of the ferrule. The tool should then be forced in the remaining distance whilst the tang is still hot.

In cases where the hole in the handle has worn very large for some reason, its shape and size may be restored by the use of a little plastic wood. Before applying this latter, however, it will be advisable to file two or three nicks or grooves along the sides of the tang, into which the plastic wood may pass and set. This simple provision will still further assist in securing the tool tang, and in preventing the handle from pulling off too easily.

Novices' Corner

Using the D-Bit

THE success of using a D-bit is dependent upon the tool being started truly in the work. There is little use in drilling a hole at random and then engaging the bit, for this can hardly be expected to give a successful result.

After the work has been centre-drilled, as illustrated in Fig. 1, operation 1, a pilot hole is made with a drill some $\frac{1}{8}$ in. smaller than finished bore size, operation 2. This hole is next enlarged with a small boring tool to afford a close working fit for the D-bit; the bore so formed should extend for a depth equal at least to the diameter of the tool itself. Operation 3.

The bit is now mounted in the tailstock drill chuck, preferably with the flat surface downwards, as this helps to free the chips from the cutting edge, and is fed into the work, operation 4. Where a pilot hole has been drilled and but little metal remains for removal, the D-bit will cut quickly and the chips formed are able, in part, to escape along the bore; but, when machining a blind hole, the bit must be withdrawn at frequent intervals to clear the chips which become imprisoned between the flat surface of the tool and the bore.

Lubrication

The bit, after being started truly on its course, in the manner described, will maintain a straight path, and on completion of the work, the bit itself will be a good working fit in the bore formed. Therefore, adequate lubrication of the shank during its passage through the work must be provided. This is particularly important when bronze or similar metals are being machined. When the cutting edge becomes worn, the tool will tend to cut undersize, and insufficient lubrication may then result in the bit jamming in the work.

Since using the D-bit is essentially a drilling operation, the lathe may be run at mandrel speeds suitable for twist drills of the same size. The tool feed should not be hurried, and the bit should be allowed to cut easily. If the tool quivers, or is seen to twist it should be withdrawn at once so that it may be cleared of chips and lubricated before being re-entered in the work.

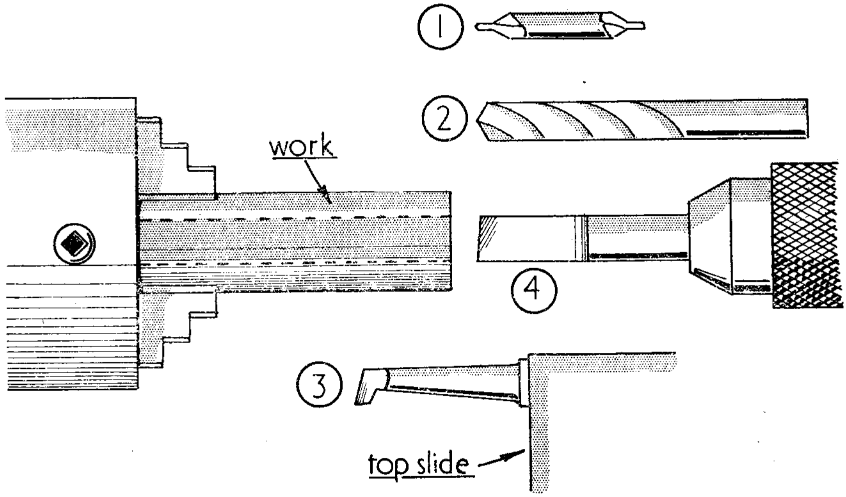


Fig. 1. Sequence of operations when drilling with the D-bit

Rather than use the handwheel when withdrawing the D-bit, it is better to pull back the complete tailstock; this procedure expedites both the removal and re-engagement of the tool.

Clean Bores

The lathe should be in motion at the time of withdrawal, but should be stationary when the bit is re-engaged with the work. The bore should be cleaned out before the bit is again engaged; otherwise, any small particles of metal present will cause the shank of the tool to bind in the work, making re-entry difficult as well as spoiling the finish of the bore itself.

Those who have a supply of compressed air available will find this cleaning process is a simple matter. Others, who are not blessed with this facility, will need to wrap a piece of rag round a short length of brass rod and work it in and out of the bore when the lathe is stationary.

Apart from the reason given above there is another which makes it essential to ensure that the bore is clean before the tool is again engaged with the work. If chips are allowed to remain in the bore, in all probability one or more of these will become lodged against the cutting edge of the bit, and the tool will be unable to do its work.

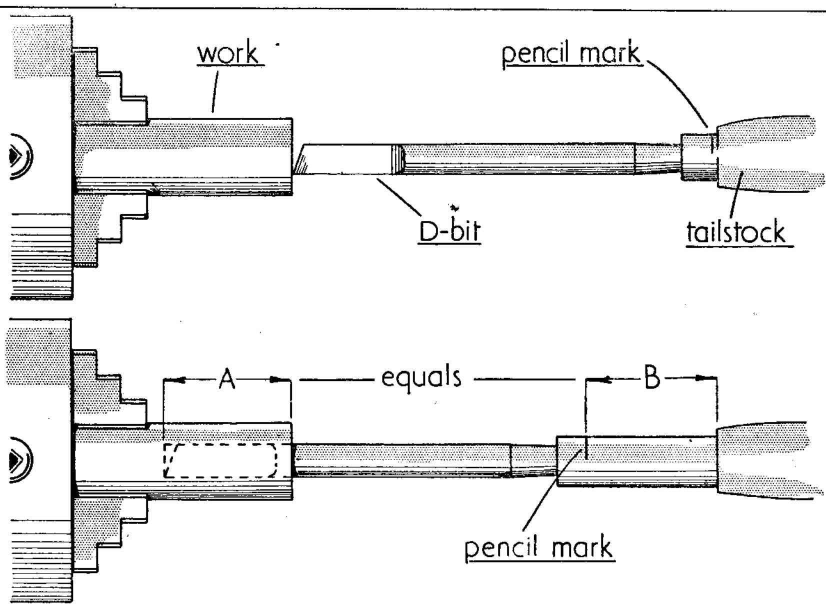


Fig. 2. Determining the progress of the work

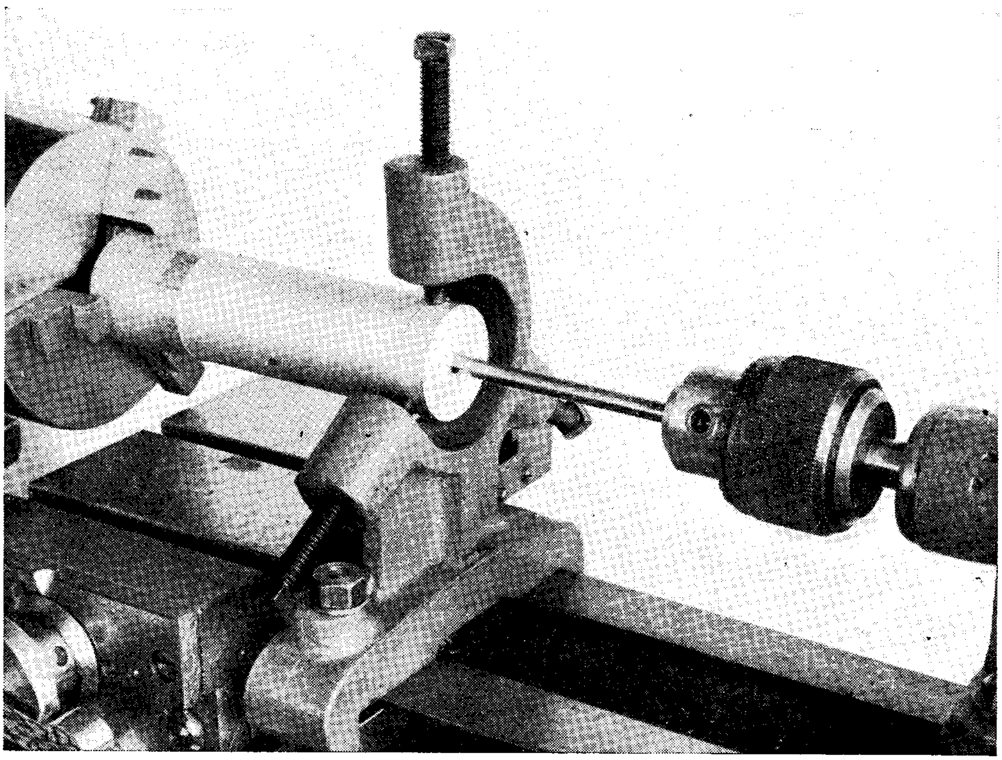


Fig. 3. Using a steady to support the work

This state of affairs will be quite apparent by reason of the resistance to movement which will be felt at the tailstock handwheel. In these circumstances, the tool should not be forced into the work but should be withdrawn so that the obstruction can be cleared.

In order to determine progress, or to bore to an exact depth, the amount of tool feed may be read off from the graduations on the tailstock barrel, where these exist, or by measuring the distance from the face of the tailstock casting to a mark made previously on the tailstock barrel itself. This mark is made when the cutting edge of the D-bit is level with the end of the work, and is shown in Fig. 2, where this method of measuring the depth of the tool's penetration is shown.

Marking the required distance with a grease pencil upon the tool itself is hardly practicable, for the cleaning and oiling of the tool shank is more than likely to obliterate any marks made upon it.

Using a Fixed Steady when Boring with the D-bit

If the workpiece is long, a fixed steady should be used to support the work in the manner illustrated in Fig. 3. As will be seen, the surface of the component is first machined so as to provide a true running path for the jaws of the steady. The turning operation must, of course, be carried out using the tailstock as a support, and the work will need to be centre-drilled for this purpose.

Great care must be exercised in engaging the steady with the work; otherwise the work becomes deflected. The jaws shown in the illustration are hardened steel screws which must be engaged by hand; it is, then, an easy matter to feel when they have made contact with the workpiece. On no account must a spanner be used, or the sensitivity needed will be lost.

When supporting work in a steady it is sometimes better to use bronze instead of steel jaws to accommodate the particular material of which the work is composed. In this event, it will be necessary to machine a set of close-fitting pads from bronze bar. These pads are then slipped over the ends of the screws and brought to bear on the work in the manner already described.

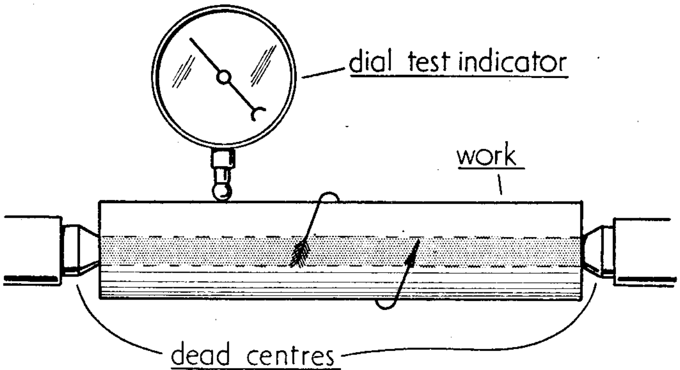


Fig. 4. Checking the work

Testing Finished Work

D-bitting will always form a *straight* hole, and it will also produce an *axial* one provided that, in the first place, the work has been set to run true by means of a dial test indicator. In many instances, axial truth is not of great importance; however, when accuracy in this respect is essential, the work should be mounted on dead-centres for checking, a dial test indicator being applied as the work is turned by hand, in the manner shown in Fig. 4. Any errors present will now be revealed. It is advisable to make tests at both ends of the work, so as to determine whether the eccentricity, if any, is uniform or otherwise.

If the degree of error is more than can be accepted, the work must be mounted between centres in the lathe, and for preference on a true-running mandrel, so that the external and end surfaces of the component can be machined.

A Motor-Driven Blower

We have examined and tested a small motor-driven centrifugal blower submitted to us by Aero Spares Co., 67-69, Church Street, Edgware Road, N.W.1. This is a very compact unit, the motor being $2\frac{1}{2}$ in. long by $1\frac{5}{8}$ in. dia., the fan casing $2\frac{1}{2}$ in. dia. and the overall length of the unit is $3\frac{3}{4}$ in. It is wound for a voltage of 27.5 V, d.c., though it will run and deliver a fairly efficient blast of air at as low a voltage as 12.

The blower is of the multi-blade type and the casing is a very neat bakelite moulding attached to the motor mounting, which is of light alloy plate. A motor of this type could be adapted to many uses in the model engineering workshop, and it could be run from the mains through a suitable transformer or resistance. One use to which it could readily be adapted is that of a miniature hair-dryer, and if fitted with the usual air heater element, the latter could be utilised as a potential divider to supply current to the motor from the mains, by tapping off a small portion of the resistance to give the required voltage to the motor.